

This is not the official court record. Official records of court proceedings may only be obtained directly from the court maintaining a particular record.

Gillespie & Powers, Inc. v. Alcoa Warrick LLC, Warrick Real Estate LLC, Kaiser Aluminum Warrick, LLC

Case Number	87D01-2201-PL-000032
Court	Warrick Superior Court 1
Туре	PL - Civil Plenary
Filed	01/14/2022
Status	01/14/2022 , Pending (active)

Parties to the Case

Defendant Alcoa Warrick LLC

Defendant Warrick Real Estate LLC

Defendant Kaiser Aluminum Warrick, LLC

Plaintiff Gillespie & Powers, Inc.

<u>Attorney</u>

Terrence L Brookie #387449, Lead, Retained

201 NORTH ILLINOIS STREET SUITE 1900 INDIANAPOLIS, IN 46204 317-237-3800(W)

<u>Attorney</u>

Benjamin James Morrical #3625549, Retained

416 N New Jersey street Apt B Indianapolis, IN 46204

Chronological Case Summary

01/14/2022 Case Opened as a New Filing

01/14/2022 Appearance Filed

Appearance

For Party: Gillespie & Powers, Inc.

File Stamp: 01/14/2022

01/14/2022 Subpoena/Summons Filed

Summons - Alcoa Warrick

Filed By: Gillespie & Powers, Inc.

File Stamp: 01/14/2022

Case 1:23-cv-00273-GBW Document 1-1 Filed 02/08/22 Page 2 of 303 PageID #: 7

01/14/2022 Subpoena/Summons Filed

Summons - Warrick Real Estate

Filed By: Gillespie & Powers, Inc.

File Stamp: 01/14/2022

01/14/2022 Subpoena/Summons Filed

Summons - Kaiser Aluminum Warrick

Filed By: Gillespie & Powers, Inc.

File Stamp: 01/14/2022

01/14/2022 Complaint/Equivalent Pleading Filed

Complaint

Filed By: Gillespie & Powers, Inc.

File Stamp: 01/14/2022

02/04/2022 Motion Filed

Motion to Amend Complaint by Interlineation

Filed By: Gillespie & Powers, Inc.

File Stamp: 02/02/2022

02/07/2022 Order Granting

Order Granting Plaintiff's Motion to Amend Complaint by Interlineation

Judicial Officer: Aylsworth, Benjamin R-Mag

Order Signed: 02/07/2022

02/08/2022 Automated ENotice Issued to Parties

Order Granting ---- 2/7/2022: Benjamin James Morrical; Terrence L Brookie

Financial Information

* Financial Balances reflected are current representations of transactions processed by the Clerk's Office. Please note that any balance due does not reflect interest that has accrued – if applicable – since the last payment. For questions/concerns regarding balances shown, please contact the Clerk's Office.

Gillespie & Powers, Inc.

Plaintiff

Balance Due (as of 02/08/2022)

0.00

Charge Summary

Description	Amount	Credit	Payment
Court Costs and Filing Fees	157.00	0.00	157.00

Transaction Summary

Date	Description	Amount
01/14/2022	Transaction Assessment	157.00
01/14/2022	Electronic Payment	(157.00)

This is not the official court record. Official records of court proceedings may only be obtained directly from the court maintaining a particular record.

Service of Process Transmittal

01/18/2022

CT Log Number 540890438

TO: Rebecca Mercado

Kaiser Aluminum Investments Company

27422 Portola Pkwy Ste 200 Foothill Ranch, CA 92610-2836

Process Served in Indiana RE:

Kaiser Aluminum Warrick, LLC (Domestic State: DE) FOR:

ENCLOSED ARE COPIES OF LEGAL PROCESS RECEIVED BY THE STATUTORY AGENT OF THE ABOVE COMPANY AS FOLLOWS:

TITLE OF ACTION: Re: GILLESPIE & POWERS, INC., // To: Kaiser Aluminum Warrick, LLC

DOCUMENT(S) SERVED:

COURT/AGENCY: None Specified

Case # 87D012201PL000032

NATURE OF ACTION: Monies Due and Owing

ON WHOM PROCESS WAS SERVED: C T Corporation System, Indianapolis, IN

DATE AND HOUR OF SERVICE: By Certified Mail on 01/18/2022 postmarked: "Not Post Marked"

JURISDICTION SERVED: Indiana

APPEARANCE OR ANSWER DUE: None Specified ATTORNEY(S) / SENDER(S): None Specified

ACTION ITEMS: CT will retain the current log

Image SOP

Email Notification, Cherrie Tsai cherrie.tsai@kaiseraluminum.com

Email Notification, John Donnan john.donnan@kaiseral.com

Email Notification, Rebecca Mercado Rebecca.mercado@kaiseraluminum.com Email Notification, Julia Patterson julia.patterson@kaiseraluminum.com

Email Notification, Veronica Hur veronica.hur@kaiseraluminum.com

REGISTERED AGENT ADDRESS: C T Corporation System

334 North Senate Avenue Indianapolis, IN 46204

866-539-8692

CorporationTeam@wolterskluwer.com

The information contained in this Transmittal is provided by CT for quick reference only. It does not constitute a legal opinion, and should not otherwise be relied on, as to the nature of action, the amount of damages, the answer date, or any other information contained in the included documents. The recipient(s) of this form is responsible for reviewing and interpreting the included documents and taking appropriate action, including consulting with its legal and other

Service of Process Transmittal 01/18/2022

CT Log Number 540890438

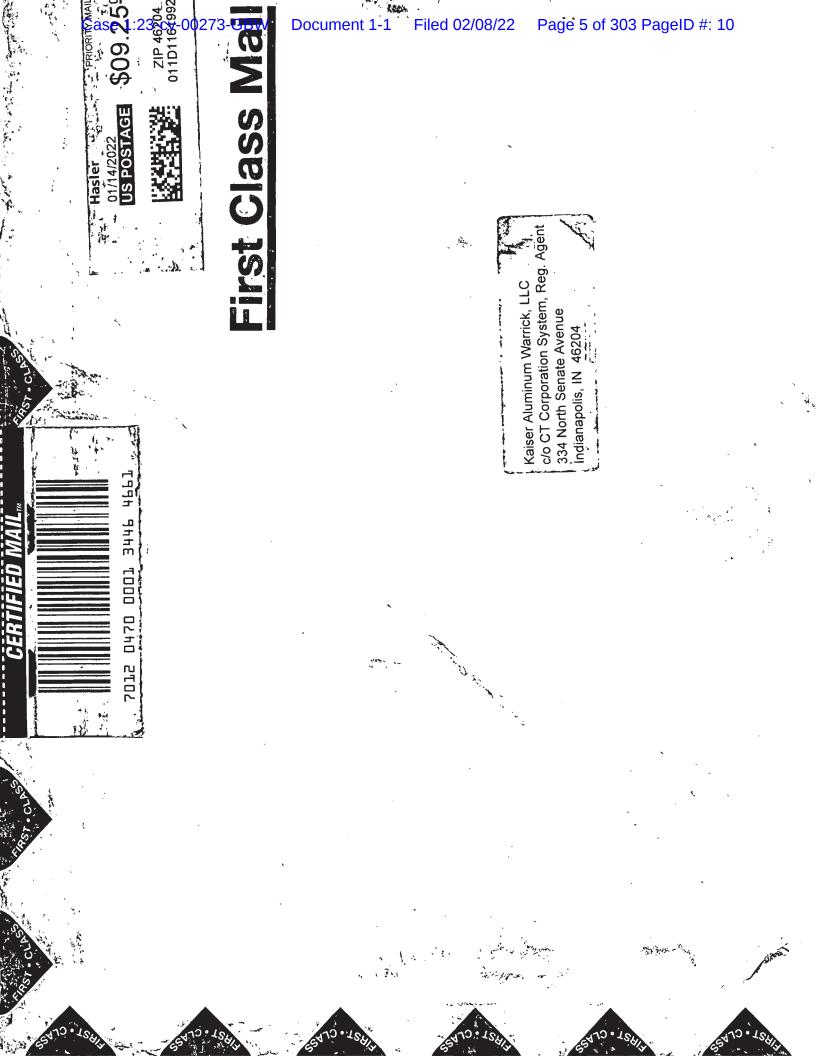
TO:

Rebecca Mercado Kaiser Aluminum Investments Company 27422 Portola Pkwy Ste 200 Foothill Ranch, CA 92610-2836

RE: **Process Served in Indiana**

FOR: Kaiser Aluminum Warrick, LLC (Domestic State: DE)

advisors as necessary. CT disclaims all liability for the information contained in this form, including for any omissions or inaccuracies that may be contained



87D01-2201-PL-000032

Warrick Superior Court 1

Filed: 1/14/2022 Warrick Superior Court 1 Warrick County, Indiana

Filed: 1/14/2022 1:50 PM

IN THE WARRICK COUNTY SUPERIOR/CIRCUIT COURT STATE OF INDIANA

GILLESPIE & POWERS, INC.,	?
Plaintiff,) CAUSE NO
v.)
ALÇOA WARRICK LLC, WARRICK REAL ESTATE LLC, and KAISER ALUMINUM WARRICK, LLC,))))
Defendants.)))

APPEARANCE BY ATTORNEY IN CIVIL CASE

This Appearance Form must be filed on behalf of every party in a civil case.

1.	The party on whose behalf this form is being filed is: Initiating \underline{X} Responding intervening; and the undersigned attorney and all attorneys listed on this form now appear in this case for the following parties:						
	Name of party: Plaintiff Gillespie & Powers, Inc.						
	Address of party (see Question # 6 below if this case involves a protection from abuse order, a workplace violence restraining order, or a no-contact order)						
	c/o FROST BROWN TODD LLC 201 N. Illinois St., Suite 1900 P.O. Box 44961 Indianapolis, IN 46244-0961 317-237-3800						

(List on a continuation page additional parties this attorney represents in this case.)

2. Attorney information for service as required by Trial Rule 5(B)(2)

 Name:
 Terrence L. Brookie
 Atty. No.:
 #3874-49

 Frost Brown Todd LLC
 Phone:
 (317) 237-3800

 Address:
 201 North Illinois St., Ste. 1900
 FAX:
 (317) 237-3900

 P.Q. Box 44961
 Email:
 tbrookie@fbtlaw.com

 Indianapolis, IN 46244-0961

	Name: Address:	Benjamin J. Morrical Frost Brown Todd LLC 201 North Illinois St., Ste 1900 P.O. Box 44961 Indianapolis, IN 46244-0961	Attorney No: Phone: Fax: Email:	36255-49 (317) 237-3800 (317) 237-3900 bmorrical@fbtlaw.com				
	(I ist on a	continuation page additional attorne	ove annearing for ah	ove narty)				
3.	,	. •						
٠.	This is a <u>PL</u> case type as defined in administrative Rule 8(B)(3).							
4.		ecept service from other parties by:						
	FAX	at the above noted number: Yes	No <u>X</u>					
	Email	at the above noted number: Yes	No <u>X</u>					
5.	security n	involves child support issues. Yes _ numbers for all family members on a ial information on light green pape t	separately attached	l document filed as				
6.	or a no – an addres exposes to	involves a protection from abuse or contact order. Yes No X ss for the purpose of legal service by the whereabouts of a petitioner.) The of legal service:	(If Yes, the initiate that address should	ing party must provide ld not be one that				
		Attorney's address						
		The Attorney General Confidentiality program address						
		(contact the Attorney Generation confidential@atg.in.gov).	al at 1-800-321-1907	7 or e-mail address is				
		_ Another address (provide)						
7.	This case	involves a petition for involuntary	commitment. Yes _	NoX				
8.		ove, provide the following regarding ry commitment:	g the individual subj	ect to the petition for				
		of the individual subject to the petit rovided in #1 above:						
	b. State of	of Residence of person subject to pe	tition:	_				
		st one of the following pieces of idea Date of Birth	ntifying information	:				
	(ii)	Driver's License Number						
		State where issued	Expiration date					
	(iii)	State ID number						

		State where issued	Expiration date
	(iv)	FBI number	
	(v)	Indiana Department of Corrections	Number
	(vi)	Social Security Number is available confidential document Yes No	e and is being provided in an attached
9.	There are	related cases: Yes NoX	(If yes, list on continuation page.)
10	. Additions	al information required by local rule:	None
	. There are ge.)	other party members: Yes No	X (If yes, list on continuation
12	. This form Yes N	<u>-</u>	and Certificate of Service is attached:
			Terrence L. Brookie
		Ter	rence L. Brookie

0146595.0739595 4859-0276-8905v1

87D01-2201-PL-000032

Warrick Superior Court 1 SUMMONS

Filed: 1/14/2022 1:50 PM Clerk Warrick County, Indiana

Filed: 1/14/2022 Warrick Superior Court 1 Warrick County, Indiana

GILLESPIE & POWI	ERS, INC.,) State of Indiana In the Warrick Circuit/Superior Court	
	Plaintiff,) in the warrick Cheulosuperior Court	
v. ALCOA WARRICK WARRICK REAL ES KAISER ALUMINU	STATE LLC, and)	
TO DEFENDANT:	Alcoa Warrick LLC c/o CT Corporation System, Reg. Agen 150 West Market Street, Suite 800 Indianapolis, IN 46204	t	

You are hereby notified that you have been sued by the person named as plaintiff and in the Court indicated above.

The nature of the suit against you is stated in the complaint which is attached to this Summons. It also states the relief sought or the demand made against you by the plaintiff.

An answer or other appropriate response in writing to the complaint must be filed either by you or your attorney within twenty (20) days, commencing the day after you receive this Summons, (or twenty-three (23) days if this Summons was received by mail), or a judgment by default may be rendered against you for the relief demanded by plaintiff.

written :	If you have a claim for relief again	ast the plaintiff arising from the same transaction or occur	rence, you must assert it is your
Dated:	1/14/2022	Clerk, Warrick County	J. C. Seell V. S.
	(The following manner of Service	Clerk, Warrick County	a de la companya de l
x	_Registered or Certified Mail		W. NOIAN AND
	Service at place of employment, to	o-wit:	
	Service on individual – (Personal	or copy) at above address by Sheriff.	
	Service on agent. (Specify)		
	_Other service. (Specify)		

Terrence L. Brookie, #3874-49
Benjamin J. Morrical, #36255-49
FROST BROWN TODD LLC
201 North Illinois Street, Suite 1900
P.O. Box 44961
Indianapolis, IN 46244-0961
(317) 237-3800
Fax: (317) 237-3900
tbrookie@fbtlaw.com
bmorrical@fbtlaw.com

SHERIFF'S RETURN OF SERVICE OF SUMMONS

I h	ereby certify th	at I have serve	d this summons	on the	day of _		20	ປ 22:
(1)) By delivering	ng a copy of	f the Summons	and a	copy of the	complaint	to the def	fendant,
which is that the above	he dwelling pla ve address.	ce or usual plac	nmons and a copce of abode of a	nd by mai	ling a copy of	said summor	ns to said de	fendant
<u> </u>								
Sheriff's C	Costs		Sheriff					
			By:	_				
			Dep	outy				
		CLER	RK'S CERTIFIC	CATE O	F MAILING			
I h and a copy requesting	nereby certify the yof the complage a return receip	nat on theint to the defenot, at the addres	day of dant, s furnished by th	ne plaintif	, 2022, I n , by _ f.	nailed a copy	of this Sum ma	mons ail,
			Clerk, War	rick Coun	ity			
Dated:		_, 2022	By:					
			Deputy					
		RETURN (ON SERVICE (OF SUM	MONS BY M	AIL		
I h the compl	ereby certify the	nat the attached lefendant	receipt was receip	eived by n	ne showing the	at the Summo	ns and a cop	py of
uay or I h	ereby certify th	nat the attached	, 2022. return receipt w	as receive	ed by me show	ing that the S	ummons an	ıd a
copy of th	ie complaint wa	is returned not a	accepted on the	day	y of		, 2022.	
	nereby certify the complaint ma	iat the attached	return receipt w	as receive	ed by me show	ing that the S	ted by	id a
		on behalf of	ant f the defendant o	n the	day of	was accep	, 2022.	•
			Clerk, War	rick Coun	ıty			
			Ву:		<u></u>			
				outy				

87D01-2201-PL-000032

Warrick Superior Court 1
SUMMONS

C4-4- - CT-- J:----

Filed: 1/14/2022 1:50 PM Clerk Warrick County, Indiana

Filed: 1/14/2022 Warrick Superior Court 1 Warrick County, Indiana

GILLESPIE & POWE	Plaintiff,) In the Warrick Circuit/Superior Court	warnek County,
v. ALÇOA WARRICK I WARRICK REAL ES KAISER ALUMINUN	TATE LLC, and)) CAUSE NO))))	-
TO DEFENDANT:	Warrick Real Estate LLC c/o CT Corporation System, Reg 334 North Senate Avenue Indianapolis, IN 46204	g. Agent	
The nature of t	·	y the person named as plaintiff and in the Court indicated omplaint which is attached to this Summons. It also state	
twenty (20) days, comr	nencing the day after you receive th	ing to the complaint must be filed either by you or you is Summons, (or twenty-three (23) days if this Summon u for the relief demanded by plaintiff.	

If you have a claim for relief against the plaintiff arising from the same transaction or occurrence, you must written answer.

Clerk, Warrick County

(The following manner of Service of Summons is hereby designated.)

X Registered or Certified Mail
Service at place of employment, to-wit:
Service on individual – (Personal or copy) at above address by Sheriff.
Service on agent. (Specify)
Other service. (Specify)

Terrence L. Brookie, #3874-49
Benjamin J. Morrical, #36255-49
FROST BROWN TODD LLC
201 North Illinois Street, Suite 1900
P.O. Box 44961
Indianapolis, IN 46244-0961
(317) 237-3800
Fax: (317) 237-3900
tbrookie@fbtlaw.com
bmorrical@fbtlaw.com

Dated:

CILLEGRIE & DOMERC DIC

SHERIFF'S RETURN OF SERVICE OF SUMMONS

I hereby certify that	I have served	this summons on th	ne day of		2022:
(1) By delivering	a copy of	the Summons an	d a copy of t	he complaint to	the defendant,
(2) By leaving a cop which is the dwelling place at the above address.	oy of the Sumr or usual place	nons and a copy of of abode of and by	f the complaint at y mailing a copy	of said summons	to said defendant
(3) Other Service of	Remarks:				•
Sheriff's Costs		Sheriff		-	
		By:			
		Deputy			
	CLERK	'S CERTIFICAT	E OF MAILING	}	
I hereby certify that and a copy of the complain requesting a return receipt,	on thet to the defenda	day of	, 2022, I , b	mailed a copy of	this Summons mail,
requesting a return receipt,	at the address	furnished by the pl	aintiff.		
		Clerk, Warrick	County		
Dated:,	2022	By:			
		Deputy			
	RETURN O	N SERVICE OF S	SUMMONS BY	MAIL	
I hereby certify that the complaint mailed to def	the attached re	eceipt was received	I by me showing twas accepted by t	hat the Summons he defendant on t	and a copy of
the complaint mailed to def day of		_, 2022.			•
I hereby certify that	the attached re	eturn receipt was re	eceived by me sho	owing that the Sur	nmons and a
copy of the complaint was: I hereby certify that	the attached re	eturn receipt was re	day of	owing that the Sur	, 2022. mmons and a
copy of the complaint mail	ed to defendan	t		was accepte	d by
	on behalf of the	he defendant on the	e day of _		, 2022.
		Clerk, Warrick	County		
		Rv			
		Deputy			

87D01-2201-PL-000032

Warrick Superior Court 1 **SUMMONS**

State of Indiana

Filed: 1/14/2022 1:50 PM Warrick County, Indiana

Filed: 1/14/2022

GILLESPIE & POWERS, INC.,	State of Indiana In the Warrick Circuit/Superior Court	Warrick Superior Court 1 Warrick County, Indiana
Plaintiff,) In the Warrex Chemis Superior Court	•
v. ALCOA WARRICK LLC, WARRICK REAL ESTATE LLC, and KAISER ALUMINUM WARRICK, LLC, Defendants.) CAUSE NO	
TO DEFENDANT: Kaiser Aluminum Warrick, LLC c/o CT Corporation System, Reg. Ager 334 North Senate Avenue Indianapolis, IN 46204	nt	
You are hereby notified that you have been sued by the g	person named as plaintiff and in the Court indic	cated above.
The nature of the suit against you is stated in the compla or the demand made against you by the plaintiff.	aint which is attached to this Summons. It also	states the relief sought
An answer or other appropriate response in writing to twenty (20) days, commencing the day after you receive this Sur mail), or a judgment by default may be rendered against you for the	mmons, (or twenty-three (23) days if this Sum	r your attorney within mons was received by
If you have a claim for relief against the plaintiff arising	g from the same transaction or occurrence, you	must assert it in your
written answer. 1/14/2022 Dated:	Datricia E. Levy	
Clerk, Warr	rick County	
(The following manner of Service of Summons is here	eby designated.)	2 WOUNT N
X Registered or Certified Mail		A STATISTICAL STATES
Service at place of employment, to-wit:		
Service on individual – (Personal or copy) at above add		
Service on agent. (Specify)		
Other service. (Specify)		

Terrence L. Brookie, #3874-49 Benjamin J. Morrical, #36255-49 FROST BROWN TODD LLC 201 North Illinois Street, Suite 1900 P.O. Box 44961 Indianapolis, IN 46244-0961 (317) 237-3800 Fax: (317) 237-3900 tbrookie@fbtlaw.com bmorrical@fbtlaw.com

GILLESPIE & POWERS, INC.,

SHERIFF'S RETURN OF SERVICE OF SUMMONS

I hereby certify	that I have serv	red this summons on the day of 2022:
(1) By delive	ering a copy o	of the Summons and a copy of the complaint to the defendant
at the above address.		ace of abode of and by mailing a copy of said summons to said defendant
Sheriff's Costs		Sheriff
\$11011113 Costs		SHOTH
		By:
		Deputy
	CLE	RK'S CERTIFICATE OF MAILING
I hereby certify and a copy of the com- requesting a return rec	y that on the plaint to the defe eipt, at the addre	day of, 2022, I mailed a copy of this Summons endant,, by mail, ess furnished by the plaintiff.
		Clerk, Warrick County
Dated:	, 2022	By:
	RETURN	ON SERVICE OF SUMMONS BY MAIL
I hereby certify the complaint mailed t	y that the attached to defendant	d receipt was received by me showing that the Summons and a copy of was accepted by the defendant on the
day of	. 41. 41 44 1	was accepted by the defendant on the, 2022. d return receipt was received by me showing that the Summons and a
copy of the complaint I hereby certify	was returned not that the attached	t accepted on the day of, 2022. Id return receipt was received by me showing that the Summons and a
<u> </u>	on behalf o	dant was accepted by of the defendant on the day of, 2022.
		Clerk, Warrick County
		By:

Filed 02/08/22

Page 15 of 303 PageID #: 20

87D01-2201-PL-000032

Warrick Superior Court 1
SUMMONS

Filed: 1/14/2022 1:50 PM Clerk Warrick County, Indiana

GILLESPIE & POWE	ERS, INC.,)	State of Indiana	Filed: 1/14/2022 Warrick Superior Court 1 Warrick County, Indiana
	Plaintiff,)	In the Warrick Circuit/Superior Court	warner county, indiana
v. -ALCOA-WARRICK. WARRICK REAL ES KAISER ALUMINUI)	CAUSE NO.	TO THE STATE OF TH
TO DEFENDANT:	Kaiser Aluminum Warrick, LLC c/o CT Corporation System, Reg. A 334 North Senate Avenue Indianapolis, IN 46204			
You are hereby	y notified that you have been sued by t	the perso	n named as plaintiff and in the Court indic	ated above.
	the suit against you is stated in the comainst you by the plaintiff.	nplaint w	hich is attached to this Summons. It also	states the relief sought
wenty (20) days, comr		Summo	complaint must be filed either by you or ns, (or twenty-three (23) days if this Sum lief demanded by plaintiff.	
•	-		n the same transaction or occurrence, you	musi assert if in your
written answer. 1/14 Dated:	1/2022 	Marrick (Tricia E. Pury	2
(The following	g manner of Service of Summons is b		**************************************	
X Registered or	Certified Mail			A Statistick
Service at pla	ice of employment, to-wit:			
Service on inc	dividual – (Personal or copy) at above	address l	by Sheriff.	
Service on ag	gent. (Specify)			

Other service. (Specify)

Terrence L. Brookie, #3874-49
Benjamin J. Morrical, #36255-49
FROST BROWN TODD LLC
201 North Illinois Street, Suite 1900
P.O. Box 44961
Indianapolis, IN 46244-0961
(317).237-3800
Fax: (317) 237-3900
tbrookie@fbtlaw.com
bmorrical@fbtlaw.com

SHERIFF'S RETURN OF SERVICE OF SUMMONS

I hereby certify that (1) By delivering	t I have served a copy of	this summons on t the Summons ar	theo	day of	nplaint to the	2022: defendan
(2) By leaving a complete which is the dwelling place at the above address. (3) Other Service of	py of the Sum or usual plac	mons and a copy of a pool	of the compl by mailing a	aint at	summons to sa	id defendar
Sheriff's Costs		Sheriff				
		By:				
	CLER	K'S CERTIFICAT	TE OF MA	ILING		
I hereby certify tha and a copy of the complair requesting a return receipt,	t on the it to the defend at the address	_ day of lant, furnished by the pl	, 2	.022, I mailed	l a copy of this	Summons mail,
		Clerk, Warrick	•			
Dated:	, 2022	By:		-		
	RETURN O	N SERVICE OF S	SUMMONS	S BY MAIL		
I hereby certify that the complaint mailed to de	the attached r	receipt was received	d by me sho was accepte	wing that the ed by the defe	Summons and ndant on the	a copy of
the complaint mailed to de day of I hereby certify tha copy of the complaint was I hereby certify tha	the attached r	, 2022. return receipt was recepted on the	eceived by r	ne showing the	nat the Summon	ns and a)22.
I hereby certify that copy of the complaint mail	the attached red to defendar on behalf of t	eturn receipt was rent the defendant on the	eceived by r	ne showing the showing the way ofw	as accepted by, 2	os and a
		Clerk, Warrick	County			
		By:				

87D01-2201-PL-000032

Warrick Superior Court 1

Filed: 1/14/2022 1:50 PM Clerk Warrick County, Indiana

Filed: 1/14/2022 Warrick Superior Court 1 Warrick County, Indiana

IN THE WARRICK COUNTY SUPERIOR/CIRCUIT COURT STATE OF INDIANA

GILLESPIE & POWERS, INC.,)
Plaintiff,) CAUSE NO
v.)
ALCOA WARRICK LLC, WARRICK REAL ESTATE LLC, and KAISER ALUMINUM WARRICK,)))
LLC,)
Defendants.)))

COMPLAINT

Plaintiff Gillespie & Powers, Inc. ("Gillespie"), by counsel, for its Complaint against Defendants Alcoa Warrick LLC ("Alcoa"), Warrick Real Estate LLC ("Warrick Real Estate"), and Kaiser Aluminum Warrick, LLC ("Kaiser"), states as follows:

ALLEGATIONS COMMON TO ALL COUNTS

- 1. Gillespie is a corporation organized under the laws of the State of Missouri with its principal place of business in St. Louis, Missouri.
- Alcoa is a limited liability company organized under the laws of the State of
 Delaware with its principal place of business in Pittsburgh, Pennsylvania.
- 3. Warrick Real Estate is a corporation organized under the laws of the State of Delaware with its principal place of business in Pittsburgh, Pennsylvania.
- 4. Kaiser is a corporation organized under the laws of the State of Delaware with its principal place of business in Foothill Ranch, California.
- 5. Gillespie and Alcoa entered an Master Service Agreement dated August 23, 2018 (the "Contract"), wherein Gillespie was to provide services, labor, equipment, materials, and

qualified supervision for the construction of a certain project (the "Project") located at 4400 State Road 66 in Newburgh, Indiana (the "Property"), in exchange for payment \$2,200,290.00. A true and accurate copy of the Contract is attached hereto as **Exhibit A**.

- 6. Alcoa was the owner of the Property at all times relevant herein.
- 7. Following the execution of the Contract, the parties agreed to subsequent amendments to the Contract in the form of revised purchased orders. A true and accurate copy of the amendments to the Contract is attached hereto as **Exhibit B**.
- 8. Furthermore, Alcoa requested changes outside Gillespie's agreed upon scope, all of which Gillespie performed.
 - 9. Gillespie submitted several change orders to Alcoa for the requested extra work.
- 10. Gillespie timely and completely performed the full scope of its work, including Alcoa requested changes, on the Project in accordance with all terms of the Contract.
- 11. Despite Gillespie's performance, Alcoa has failed to pay Gillespie the full amount owed for such work pursuant to the Contract, including but not limited to, work performed under the Contract and its amendments, change order work and un-scoped meeting labor for the Project.

COUNT I – BREACH OF CONTRACT

- 12. Gillespie incorporates by reference all allegations set forth in Paragraphs 1 through 11 of this Complaint as if fully restated herein.
- 13. After all credits, the principal amount due and owing to Gillespie under the Contract is \$2,473,226.36.
- 14. Gillespie has fully performed its obligations under the Contract in a good and workmanlike manner, free from defect.

- 1 ago 10 or 000 r agorb 77. 2 r
- 15. Gillespie satisfied all conditions precedent to Alcoa's obligation to pay Gillespie in full.
- 16. Alcoa has unjustifiably failed to pay the amounts owed to Gillespie under the Contract, despite repeated demands from Gillespie.
 - 17. Alcoa's failure to pay Gillespie constitutes a breach of the Contract.
- 18. Gillespie has suffered and continues to suffer damages, including attorney fees, as a result of Alcoa's breach of the Contract.

WHEREFORE, Gillespie, by counsel, respectfully requests that this Court enter judgment in its favor and against Alcoa in excess of \$2,473,226.36 to compensate Gillespie for the damages caused by Alcoa's breach of the Contract, for the costs of this action, for pre- and post-judgment interest, for attorneys' fees and for all other just and proper relief.

COUNT II – UNJUST ENRICHMENT

- 19. Gillespie incorporates by reference all allegations set forth in Paragraphs 1 through18 of this Complaint as if fully restated herein.
- 20. Gillespie has conferred a benefit upon Alcoa by providing materials, labor, and/or services for the improvement of the Property pursuant to Gillespie's work on the Project, at the insistence and request of Alcoa.
- 21. At all relevant times, Alcoa knew Gillespie was providing work on the Property, acquiesced in Gillespie's provision of said work, and accepted and received the benefit of the materials, labor, services, improvements, and/or actions provided by Gillespie's work.
- 22. Gillespie performed its work in a timely, good and workmanlike manner, free of defect.

- 23. The fair and reasonable value of the work performed by Gillespie on the Project is \$2,473,226.36.
- 24. The acceptance and retention by Alcoa of the benefit provided by Gillespie pursuant to the Contract is such that it would be inequitable for Alcoa to retain those materials, labor, services, and/or improvements without paying the value thereof, and would amount to an unjust enrichment.

WHEREFORE, Gillespie, by counsel, respectfully requests that this Court enter judgment in its favor and against Alcoa in excess of \$2,473,226.36 to compensate Gillespie for the damages caused by Alcoa, for the costs of this action, for pre- and post-judgment interest, and for all other just and proper relief.

COUNT III - FORECLOSURE OF MECHANIC'S LIEN

- 25. Gillespie incorporates by reference all allegations set forth in Paragraphs 1 through 24 of this Complaint as if fully restated herein.
- 26. On January 15, 2021, within ninety (90) days of the last date on which materials, labor, and/or services had been furnished by Gillespie in relation to the Project and pursuant to Ind. Code § 32-28-3-3, Gillespie filed in the Office of the Recorder of Warrick County, Indiana, a Sworn Statement and Notice of Intention to Hold Mechanic's Lien (the "Lien") on the Property and the Project. A true and accurate copy of the Lien is attached hereto as **Exhibit C**.
- 27. Gillespie has complied with all statutory requisites for the filing and perfection of its Lien on the interest of Alcoa in the Property.
- 28. Gillespie asserts and has a lien in and to all the right, title, and interest in the Defendants' interest in the Property and improvements thereon to secure the indebtedness owed to Gillespie in the amount of \$1,186,662.00, plus interest and attorneys' fees.

Case 1:23-cv-00273-GBW

- 30. All the materials, fixtures and labor furnished by Gillespie were delivered to and accepted for improvement of the Property and constitute a permanent and valuable improvement of said Property.
- 31. All labor performed and materials furnished by Gillespie were consented to and authorized by the owner of the Property and the improvements thereon.
- 32. Kaiser is named as a defendant in this matter to answer as to its interests in the Property.
- Gillespie's Lien is a valid and enforceable Lien on the Property, subject only to any 33. prior and superior lien or encumbrance.

WHEREFORE, Gillespie, by counsel, respectfully requests that this Court enter judgment against Alcoa and Warrick Real Estate in an amount in excess of \$1,186,662.00 to compensate Gillespie for damages caused by Alcoa, together with interest, the costs of this action, attorneys' fees, and the expense of a title report. Gillespie further requests that the Court order and declare the Lien the first and valid lien on the aforementioned Property, for an Order directing the Sheriff of Warrick County to sell, at a foreclosure sale, the above-described Property to pay the judgment and to apply the proceeds realized therefrom at public sale, first toward the cost of this action, next to Gillespie's judgment, and the balance, if any, to be paid to the Clerk of the Court to be distributed upon further Order of this Court. Gillespie further requests that upon judgment, if the proceeds of the sale of the real estate shall not be sufficient to satisfy Gillespie's claim, a deficiency judgment be entered in favor of Gillespie and against Alcoa and Warrick Real Estate until such judgment is satisfied in full, and for all other just and appropriate relief.

FROST BROWN TODD LLC

By: /s/ Terrence L. Brookie

Terrence L. Brookie, #3874-49 Benjamin J. Morrical, #36255-49 Attorneys for Plaintiff, Gillespie & Powers, Inc.

FROST BROWN TODD LLC 201 N. Illinois St., Suite 1900 P.O. Box 44961 Indianapolis, IN 46244-0961 P: 317-237-3800 F: 317-237-3900 tbrookie@fbtlaw.com bmorrical@fbtlaw.com

0146595.0739595 4888-6335-8217v1

Document 1-1 Filed 02/08/22

87D01-2201-PL-000032 Warrick Superior Court 1

Filed: 1/14/2022 1:50 PM Warrick County, Indiana



Agreement Number: CW2265068

MASTER AGREEMENT FOR PROCUREMENT OF SERVICES

This MASTER AGREEMENT ("Agreement") dated this 23rd day of August 2018 by and between Gillesipie & Powers Inc ("Seller"), a Missouri Corporation and Alcoa Warrick LLC, a Delaware Corporation and its Affiliates ("Company").

WHEREAS, Seller wishes to sell Services (defined herein) to Company and Company wishes to order and purchase such Services from time to time;

WHEREAS, the parties wish that the terms of this Agreement be utilized by Company Affiliates (as defined below) if Company Affiliates choose to participate in this Agreement by issuing a purchase order and/or participation agreement referencing this Agreement.

NOW THEREFORE, in consideration of the mutual covenants and agreements set forth herein, and for other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, Company and Seller, intending to be legally bound, agree as follows:

- TERM. This Master Agreement is for a term of TWO (2) years and shall commence on the 23rd day of August 2018 and terminate on the 23rd day of August 2020.
- PARTIES. Seller and Company have negotiated this Agreement pursuant to which Company and Company Affiliates may purchase Services from time to time from Seller and its affiliates in the United States and various countries where such parties wish to transact business. The term "Affiliates" is defined as those subsidiaries or affiliates of Company that enter into this Agreement by issuing an order or, in the case of foreign Affiliates, executing a participation agreement such as a contract addendum that specifies any changes that Seller and such Affiliate(s) agree to make to the Agreement based on local law, local operational practice or other concerns that will apply solely to the performance of this Agreement for the Affiliate(s) that executes the relevant participation agreement. The terms of this Agreement and the applicable participation agreement will apply between Seller and the Company Affiliate and references to "Company" means the Company Affiliate that has executed a participation agreement and placed an order and references to "Seller" means Seller or its local affiliate in each country that provides the Services pursuant to an order. Each order issued by Company or its Affiliate(s) to Seller related to this Agreement and any applicable participation agreement will constitute a separate contract between such parties. Seller will directly invoice each Company location or Company Affiliate that issued the order.
- SERVICES / QUANTITIES. Seller agrees to sell the Services listed and described in the Statement of Work, Attachment A ("Services") as Company may order, from time to time, at quantities identified in the applicable purchase order and/or participation agreement(s). The Services will meet all the requirements and specifications more particularly described on Attachment A.
 - 4. PRICE. The prices for the Services are identified in Attachment B.
- TERMS AND CONDITIONS. The terms and conditions governing the purchase orders issued pursuant to this Master Agreement are set forth in Attachment C.

- 6. <u>STANDARD TRANSACTIONAL FLOWPATH</u>. The process requirements set forth in Attachment D shall govern all purchase orders or contracts governed by this Master Agreement.
- 7. <u>INCORPORATION BY REFERENCE</u>. Attachments A through D are attached hereto, made part hereof, and incorporated by reference herein.
- 8. <u>ENTIRE AGREEMENT</u>. This Master Agreement together with the Company purchase order, attachments and any applicable participation agreements sets forth the entire agreement between Company and Seller with respect to the subject matter hereof and supersedes and overrides all other prior negotiations, commitments, writings including, but not limited to, terms and conditions contained in any documents provided by Seller in connection with its obligations hereunder. Any references to Seller's quotation, terms and conditions or other form of offer for the Services is for informational purposes only and any attempt by Seller to vary the terms of this Agreement in any degree will be deemed material and expressly objected to and rejected by Company.
- 9. <u>PRECEDENCE OF DOCUMENTS</u>. In the event of any conflict between the attachments of this Master Agreement, the order of precedence will be as follows:
 - A. This Master Agreement
 - B. Attachment C Terms and Conditions
 - C. Attachment B Price
 - D. Attachment A Services
 - E. Any specific or special terms set forth on Buyer's PO
- 10. <u>NOTICES</u>. All notices required or permitted to be given pursuant to this Master Agreement or any of the Attachments hereto shall be in writing and shall be valid and sufficient if dispatched by a) registered or certified mail, postage prepaid, in any post office in the United States; b) hand delivery; c) overnight courier; or d) facsimile transmission upon confirmation of receipt.

If to COMPANY:

Alcoa Warrick LLC Hiway 66 East Newburgh, IN 47630 Fax () Attn: Steve Richardson

If to SELLER:

Gillesipie & Powers Inc 9550 True Drive St. Louiis , MO 63132 Fax () Attn: Ian Marsh

Each party may change its address or other notice information in any respect, by giving written notice to the other party.

11. <u>COUNTERPARTS</u>. This Agreement may be executed in any number of counterparts, which together shall constitute one and the same document.

IN WITNESS WHEREOF, the parties have caused this Agreement to be executed by their duly authorized representatives as of the date first above written.

Alcoa Warrick LLC

By:_

Name: Steve Richardson

Title: Capital Procurement Manager US

Date:

Gillesipie & Powers Inc

Name: Title:

Date:

3/0/20-

ATTACHMENT A - SERVICES; QUANTITIES

6.

BC-8175R6 Alcoa

CSM Project - COMM The agreed upon scope of work is contained in the attached file with pricing as

well.

ATTACHMENT B - PRICING

Pricing for the scope of work is contained in attachment A

ATTACHMENT C- Terms and conditions in accordance with MSA

COMMERCIAL BID PROPOSAL

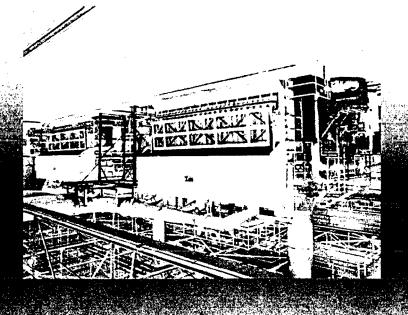
FOR

ACOA

CSM PROJECT

CPX Bid No: BC-8175 R6

8102,02 tauguA



9550 True Drive Saint Louis, MO 63132

Gillespie & Powers, Inc.

9707-326-008

Fax: 314-428-4431

Phone: 314-423-9460

Engineering Service | Industrial Furnaces | Refractory Services

Gillespie & Powers, Inc.



Email: steven_richardson@alcoa.com

August 20, 2018

Mr. Steve Richardson Capital Procurement Manager US Old State Rd. 66 Newburgh, IN,47630

RE: COATED SCRAP MELTER (CSM) PROJECT
GPX BID NO. BC-8175 R6 (Commercial Proposal)

Dear Mr. Richardson,

We are pleased to confirm to you the agreements we have reached over the last few days via email. Further this revision incorporates details and corrections from R3.

We submit to you this commercial proposal for your use based on your invitation CSM-R1 Dated 02-13-2018 including up to Addendum 9, and the review meeting and questions from April 25th, 2018, our discussions and emails of August 2018 to provide a Coated Scrap Melter (CSM) system in accordance with your requirements. All information regarding specific component selection is subject to revision during final design and input from the customer.

Gillespie & Powers is recognized as the world leader in delacquering technologies. Having designed and built delacquering and incinerator technology for more than 30 years and involved in the earliest projects for these applications. The result of all this real life experience has resulted in a deep understanding of the process and the parameters that need control during this process. We have been awarded several patents along the way for components and processes that relate directly to the delacquering of aluminum. With installations around the world, most of which are still in operation today, GP is best positioned to incorporate controls and components to deliver a desired product and process.

9550. True Drive St. Louis, Missouri 63132 314-423-9460 Main Office 800-325-7075 Toll Free Line 314-428-4431 Facsimile

General Information: info@gillespiepowers.com

Additional information on the Web: www.gillespiepowers.com Delivery of the ready for production furnace can be expected to take, from the issue of a purchase order, an estimated 57 weeks to engineer, procure equipment and materials, fabricate necessary components, install and commission.

This Commercial Proposal is submitted in conjunction with Technical Proposal BC-8175 R1 and drawing BC-8175 sheets 1, 2, 3, & 4.

Regards,

Gillespie & Powers, Inc.

Jan Marsh

lan Marsh

imarsh@gillespiepowers.com

ICM:fc

Items Included / Clarified in this Revision

- 1. Omitted in the specification, but please add wireless remote operation for the charge & skim doors. This includes 3 remote devices, each of which will operate all 3 furnace doors. This item is now included.
- 2. Furnace Mfg is responsible for ALL painting per Section C.15. This includes all touch-up painting required on-site to meet the specification of C.15. Acknowledged and was previously understood and included.
- 3. Include hard copies of prints, manuals, and drawings per spec (Sections C.30 & C.31) We now include three hard copy sets as well as the 3 electronic copies
- 4. It is the Contractor's responsibility to provide rest rooms, break areas, drinking water, and internet access for their employees. (Per Sections B.1 and B.2) This was previously understood and included in our price.
- 5. Contractor must provide and route the cable from contractor's temporary power supplies to the Alcoa PDP. Alcoa will connect the contractor provided cable to Alcoa's PDP. (Per Spec Section B.2, Item 7). This is now included in our scope and price.
- 6. GP allocated 21 days for 2 people for startup & training. Is this 420 manhours? This should provide technical support up to the completion of slow melt. (Alcoa requested 460 mnhrs per Spec Section C.37)
 - Technical support required for Acceptance Testing is NOT included in the above 420 mnhrs and is the responsibility of the contractor. Make sure the cost for these support personnel are included in the contractor's cost. (See Spec Section D for statement in multiple locations... "Seller shall furnish all test equipment and support personnel for the duration of the Performance & Acceptance testing described below." This is well understood. Gillespie & Powers has never and will never walk away from a project. Start Up, Commissioning, Training, Hand Over and Performance Testing are all covered by our initial quotation.
- 7. GP allocated 30 weeks for Project Manager. Contractor is responsible for schedule, coordination and equipment and therefore for duration of project. Allocation is NOT accepted. This particular statement was actually related to an overseas project. Whatever is required is what will be provided and is included in the price.

- 8. 120 hours for system integration sounds light?? (I think about 3x??) In this instance where GP is the provider of all the equipment and systems this is moot. The 120 hours relates to integration of various other systems that can be involved in a project such as this where GP may not be the supplier and installer. In this instance it would just be providing ethernet hookup for the plant Scada system. (No level 2 programming or reporting is included, only the provision of information access) Anything required after 120 hours will be billed at standard engineering rates.
- 9. Capture hoods for ALL furnace doors & vortex (If not already included) This was included in our initial proposal submission.
- 10. Salt storage, injection, & measuring system. (This was requested in Addendum #3) This is added in this revision.
- 11. Budgetary installed cost for baghouse location on both the north & south wall of 134. This shall include the cost for foundations and backfill. (See Spec Section C.28) Per the direction in the meeting this revision includes the South location with an adder for the North Location
- 12. If not already included, add the supply, fab, and install of the Alcoa Vortex Ingestion System. With the exception of the Alcoa proprietary shapes & circulation impeller drive supply, this was all included in our original submission. In this revision we have added the supply of these shapes and (1) circulation impeller drive complete (mechanical and refractory) to this revision.

It also includes these clarifications from Stephen LaJoie email of June 27, 2018:

- Working in cooperation with Alcoa and PAI to identify and design the most economical and efficient routing for the duct between the furnace and the baghouse.
- 2. Included design, fabrication and installation for the duct.
- Included that GP will provide the bands (or direct attachment method between the duct and the Alcoa provided support). Alcoa will provide the duct support based upon the duct weight provided by GP and the agreed upon routing.

- 4. If agreed upon routing is over the roof GP has included a plan and the cost for installation above the roof of Bldg 134. This could possibly include the cost of a large mobile crane with over 175ft horizontal reach and over 75ft vertical reach to install the duct above the Bldg 134 roof. Depending on size and routing, there might be a requirement for pedestrian cross-over stairs.
- 5. If agreed upon routing is below the roof line and above the overhead crane envelope - GP has included the cost for mobile equipment, crane watches, relocation of utilities, building modifications, and construction downtime. (Note that the #1 South bay crane that operates in the area where the duct will be installed can't be shut down for more than a couple of hours in each 24 hour period since it handles every single ingot that is cast and cut at the "Scrap Saw." Depending on the size and weight of the duct, there may not be sufficient bearing capacity or room available in the current roof design and a there may not be a direct path without relocations or modifications required.)

I. COMMERCIAL PROPOSAL

1. PRICING

Gillespie & Powers is proposing to furnish the complete design, supply, and installation and start-up for the following:

1.1 One (1) CSM System with South Baghouse Location: \$ 11,634,600

\$708,375.00 Engineering \$10,926,225.00 Equipment, Installation et al

1.2 One (1) Optional Charging Machine: \$ 1,111,000

1.3 Budget Price for Foundation Work: \$ 605,000

1.4 Firm Offer – This pricing is valid for The Purchase Order for the Engineering Portion issued prior to the end of the work week of August 20, 2018. The Purchase Order for the Supply and Installation Portion is to be issued prior to the end of the work week of December 10, 2018. Any deviation from these dates will result in a corresponding deviation in schedule.

PAYMENT SCHEDULE AND TERMS

We have mutually agreed to the following payment schedule and terms

For Engineering portion will be

50% with Order August 20, 2018

25% upon Presentation of GA's for Customer Approval October

29, 2018

25% Week of April 8, 2019

Completed As-Built drawings are expected six (6) weeks after acceptance testing has been completed.

There will be a \$50,000 holdback from the final payment to the engineering cost for As-Built Drawings. Damages shall be assessed at \$10,000 per week up to 5 weeks. Final payment of engineering will not be made until the accuracy of these drawings has been verified by Alcoa. This will be in addition to the 5% contract price cap on Liquidated Damages for Delays as stated in the RFQ.

This is agreed to under one additional condition, that being Alcoa has the same 2 weeks to review said drawings and that their review period is not eligible for assessing damages and further the date of commencement of this clock will need to be defined specifically.

All invoicing is payable Net thirty (30) Days.

For the Supply Portion will be

- 15% due upon issuing of purchase order August 20, 2018
- 25% due final acceptance of general arrangement drawings December 17, 2018
- 20% due upon ordering of major components (Combustion, Stirrer, Conveyors, Shell) March 11, 2019
- 20% due upon start of installation May 13, 2019
- 10% due upon completion of installation August 19, 2019
- 10% due upon acceptance by customer; not to exceed 60 days after final equipment commissioning. September 30, 2019

Note: partial shipments and payments are applicable All invoicing is payable Net thirty (30) Days.

Adjustments in schedule will be made if dates are not met for order issuance.

2. DELIVERY SCHEDULE

Delivery of the ready for production furnace can be expected to take, from the issue of a purchase order, an estimated 57 weeks to engineer, procure equipment and materials, fabricate necessary components, install and commission.

In order to facilitate this schedule it is agreed that at approx. 9 weeks all foundation loading data for major equipment will be supplied to enable a separate vendor to perform civil engineering. Including

- 1. Foundation design criteria for both Baghouse & Furnace (includes all loading requirements)
- 2. ALL embeds necessary for furnace & baghouse. Utilities and power feeds to furnace proper MUST be embedded and can't be routed overhead.
- 3. Duct sizing and loading requirements
- 4. Utilities requirements for Alcoa provided feeds and Take-over points

Attached to this document are preliminary schedules for the installation BC-8175 SCH Rev. 2. A detailed project schedule will be prepared within two weeks after purchase order is issued.

3. WARRANTIES

- 3.1 GILLESPIE & POWERS expressly warrants the equipment manufactured by it as meeting the functional requirements as stated in its technical bid proposal. The Purchaser shall retain responsibility for its decision as to the suitability and functional adequacy of the offering for the required purpose.
- 3.2 The following constitutes the exclusive remedies which will be undertaken by GILLESPIE & POWERS in the event of any breach of its Warranty:
 - 3.2.1 Materials and Workmanship: GILLESPIE & POWERS guarantees to the Purchaser that all steel and non-standard mechanical items manufactured and supplied by GILLESPIE & POWERS to be fit for the purpose intended and to be free from defects in workmanship and material. If any such defects exist or later appear within twenty four (24) months of the date of startup. GILLESPIE & POWERS agrees at its expense to take prompt remedial action as stated herein, to correct the same, provided, however, that GILLESPIE & POWERS shall have no obligation or liability under this warranty unless it shall have received written notice specifying the defect no later than twenty four (24) months from date of start-up. GILLESPIE & POWERS agrees to replace or repair, at its option, any such product, component, or part thereof, transportation charges prepaid, for the account of the Purchaser. The cost of demonstrating the need to diagnose such defects at the installation site, if required, shall be for the account of Purchaser. Any product or component, or part thereof repaired or replaced, shall be warranted by GILLESPIE & POWERS for the remainder of the original warranty period.
 - Resale Products: Resale products shall carry only the 3.2.2 warranty offered by the original manufacturer, and will be extended in the context of their original terms to the Purchaser, unless specified otherwise in the offering or agreed upon, in writing, by GILLESPIE & POWERS. GILLESPIE & POWERS shall have no responsibility for the functioning of resale products specified by Purchaser or his agent.
 - 3.2.3 Refractory Lining: The refractory lining will come with a standard 12-month warranty, except for abuse & normal wear,

starting from completion of dry-out.

- 3.2.4 Product Usage: Since after commissioning the product is under the sole control of the Purchaser, the warranty is subject to, and shall be applicable only if the following conditions are met:
- 3.2.5 Gillespie & Powers instructions as to operation and maintenance have been duly followed;
- 3.2.6 The product has been properly operated and maintained;
- 3.2.7 The product has not been operated in a fashion for which it was not intended or outside of the specified and rated operating range for which it is intended.
- 3.2.8 The product has not been affected by misuse, neglect, or accident. All repairs and replacements necessitated by inadequate preventative maintenance, normal wear and usage, by the fault of the user, or power sources supplied by others or by attack and deterioration by unsuitable environments shall be for the account of the Purchaser.
- 3.2.9 The Purchaser has not attempted or performed corrective work or modifications without Gillespie & Powers prior written consent as to the nature and expense thereof. Gillespie & Powers accepts no consequential liability resulting from such attempt or modification; and
- 3.2.10 The limits of liability are restricted to the cost of repairing or replacing the faulty or defective equipment or workmanship so long as such faults are noted to have taken place within the prescribed warranty period and that Gillespie & Powers is given notification in writing as soon as any defect is observed. GILLESPIE & POWERS will respond in a prompt manner to any such notification. GILLESPIE & POWERS shall have received notice of the defect no later than thirty (30) days after the Purchaser first has knowledge of same.
- 3.2.11 Component warranties are F.O.B. GILLESPIE & POWERS.

4. SPARE PARTS

We will provide start-up spares for the commissioning of the equipment. A complete detailed list of spares for a 1-year operating period will be submitted thirty (30) days prior to the shipment of equipment to site. Spare parts are not included in any of the above pricing except for start-up spares and the requested spare transfer pumps.

Note: Typical start-up spares include:

- Combustion spares
- System components (pressure switches, solenoid valves, etc.)
- Flame safety/Burner Control Unit
- PLC analogue I/O modules
- Thermocouples
- Proximity switch, limit switch, relays
- Hydraulic components

5. PERFORMANCE AND ACCEPTANCE TESTING

- 5.1 Performance Tests: The Performance and Acceptance Test, conducted under the strict supervision of the Purchaser's representative, will utilize Purchaser's supplied products and materials. The testing will be a documented test series, arranged to check every facet of the furnished and installed equipment for its conformity with the Purchaser's specifications for each furnace chamber and the charging machine. The acceptance test procedures will be the subject of discussion between the GILLESPIE & POWERS and the Purchaser and must be approved by both before testing occurs.
- 5.2 Full Acceptance: Full acceptance will be defined as the ability of the installed equipment to meet the requirements of this specification. This acceptance will be attained within sixty (60) calendar days after completion of field installation. If failure to complete the test falls upon the Purchaser, Purchaser will by default be in acceptance of the installed equipment.

6. DOCUMENTATION

GILLESPIE & POWERS will provide Purchaser with up to the following quantities of applicable drawings and instructions unless specified otherwise in the offering or agreed upon, in writing, by GILLESPIE & POWERS. Additional copies will be furnished at extra charge.

Drawings – complete set in AutoCAD 2004 format and three (3) hard copies. Drawings for resale products shall be those provided by GILLESPIE & POWERS suppliers.

Instruction Manuals – Three (3) hard copies applicable instructions for installation, operation, and maintenance, as defined by GILLESPIE & POWERS in English.

The documentation shall include:

- 1. Installation / Startup,- Installation Dwg's will be in Manual, and Start-up procedure
- 2. Equipment Operation and Setup (for Production Personnel)-This will be covered in Training and will be added in to the manual
- 3. Equipment Operation and Setup (for Maintenance and Engineering Personnel) This will be covered in Training and will be added in to the manual
- 4. Lockout / Tagout / Tryout Procedures (for complete isolation of the system and isolation of any component which may require "on-line" service)
- 5. Mechanical Maintenance Procedures
- 6. Lubrication Schedule and Mapping of Lubrication Points
- 7. Mechanical Maintenance Troubleshooting
- 8. Electrical Maintenance Procedures
- 9. Ladder Logic Listings
- 10. Electrical Maintenance Troubleshooting, ALL 3RD PARTY PURCHASHED PARTS MANUALS WILL BE SUPPLIED. THEREFORE WHATEVER TROUBLE SHOOTING EACH MANUAFACTURE PROVIDES WILL BE INCLUDED. NO ENHANCEMENT OF THESE PROCEDURES IS INCLUDED.

- 11. Sequence charts and timing diagrams for all modes of operation indicating valve status, position and pressure data, and command and feedback signals for all phases of the machine cycle. This will be provided after start-up and commissioning
- __12. Preventative Maintenance Program (including daily checklists, weekly/monthly/quarterly/annual PM functions
- 13. Original Manufacturer's Specification Sheets Copies of original manufacturer specification sheets for purchased items. (Drawing numbers referenced for each item)
- 14. Recommended Spare Parts List: Mechanical, Combustion, Pneumatic, Refractory, and Electrical. (Drawing numbers referenced for each item)
- 15. Spare Parts List, including pricing, manufacturer, original manufacturer's part number, suggested supplier, and approximate lead time shall be sent for approval prior to shipment of equipment. NOTE: The spare parts list shall be provided no later than ONE (1) month prior to shipment of equipment to allow Buyer to purchase and have on hand the required spare parts during start-up and commissioning.

Any documentation provided will be preliminary until after start up and commissioning. This is necessary to ensure all as built data is incorporated into the final documentation. Therefore the final manual will be delivered not later than six (6) weeks after hot commissioning.

II. **GENERAL EXEMPTIONS AND CLARIFICATIONS**

- 1. State and federal sales tax is not included
- 2. All prices are in US dollars and are based on working straight time only. No overtime or holidays are included in the base bid. All pricing is based on working 8 hour shifts - 5 days per week.
- 3. Dumpsters and disposal of construction material provided by Purchaser.
- 4. Pricing does not directly include civil or any foundation work.
- 5. Furnace utility tie-ins to be within 50 feet.

- 6. Utilities and potable water are to be provided to the seller by purchaser and to be within 25'-0" of the work area. Sellers' 440-volt transformer hookup to be provided by purchaser.
- 7. Spares are an extra to this quotation except as noted in Section 4.
- 8. Any necessary preparations or modifications to the site, or peripheral equipment required to accept the equipment.
- 9. The dry hearth door opening will be sized to accept a 92 inch diameter coil. However, GILLESPIE & POWERS cannot guarantee that coils will be properly decoated. In our experience with trying to decoat coils on a dry hearth the coatings cannot properly volatize in a tightly wrapped / rolled coil.

TECHNICAL PROPOSAL

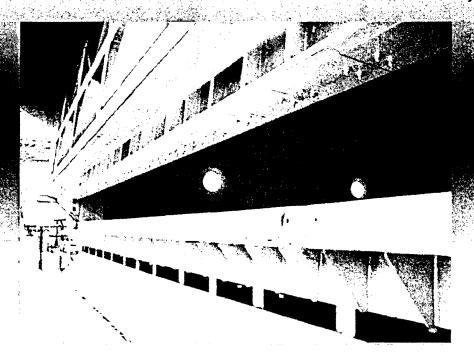
FOR

ALCOA

CSM PROJECT

GP Bid No: BC-8175 R1

May 11, 2018



9550 True Drive Saint Louis, MO 63132

Phone: 314-423-9460

Fax: 314-428-4431

800-325-7075





Gillespie & Powers, Inc.

www.gillespiepowers.com

Engineering Service | Industrial Furnaces | Refractory Services

Gillespie & Powers, Inc.



Email:dsikora@projectassociatesinc.com

May 11, 2018

Mr. Dennis Sikora Procurement SPA Alcoa Warrick.

9550 True Drive St. Louis, Missouri 63132 314-423-9460 Main Office 800-325-7075 Toll Free Line 314-428-4431 Facsimile

General Information: info@gillespiepowers.com

Additional information on the Web: www.gillespiepowers.com

RE: COATED SCRAP MELTER (CSM) PROJECT GPX BID NO. BC-8175 R1 (Technical Proposal)

Dear Mr. Sikora,

We are pleased to submit to you this commercial proposal for your review based on your invitation CSM-R1 Dated 02-13-2018 including up to Addendum 7, and the review meeting and questions from April 25th, 2018 to provide a Coated Scrap Melter (CSM) system in accordance with your requirements. All information regarding specific component selection is subject to revision during final design and input from the customer.

Gillespie & Powers is recognized as the world leader in delacquering technologies. Having designed and built delacquering and incinerator technology for more than 30 years and involved in the earliest projects for these applications. The result of all this real-life experience has resulted in a deep understanding of the process and the parameters that need control during this process. We have been awarded several patents along the way for components and processes that relate directly to the delacquering of aluminum. With installations around the world, most of which are still in operation today, GP is best positioned to incorporate controls and components to deliver a desired product and workable solutions.

Gillespie & Powers would supply all engineering, fabricated items, combustion & control systems, refractory materials, installation, start-up and commissioning as described for the below CSM processing equipment.

- Charge Hopper and Conveyors to load an Alcoa Vortex ingestion system
- Salt Fluxing system to control the volume of salt entering the vortex system
- · Furnace with Dry Hearth Charging of Coated Scrap to Delacquer prior to melt - - -
- Internal Well for melting and Circulation
- Melting and Holding Chamber with 275,000 lb. Capacity
- APC System including lime injection

This technical proposal is to be in conjunction with Commercial Proposal BC-8175 R1, drawing BC-1875 sheets 1, 2, 3, & 4, and Project Schedule Chart BC-8175-SCH rev 1.

We would be available to visit you to discuss our proposal in detail. Thank you for the opportunity of submitting this quotation and we look forward to the privilege of serving you on this project

Regards,

Jan Marsh

Ian Marsh Gillespie & Powers, Inc. imarsh@gillespiepowers.com

CC: Mr. Terry Haynes terry.haynes@alcoa.com

Attachments:

Appendix 1 Independent Review and Analysis of GILLESPIE & POWERS MCAM Appendix 2 Eductor Flow Models (Static) Appendix 3 Refractory Thermal Heat Flows

BC-8175 R1 TECHNICAL PROPOSAL INDEX CSM SYSTEM

- 1. OVERVIEW
- 2. QUALITY AND SAFETY
- 3. GENERAL CODES & STANDARDS
- 4. CSM SYSTEM
 - 4.1. DESIGN CRITERIA
 - 4.2. DESIGN FEATURES & EQUIPMENT
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 - 4.5. TECHNICAL DATA
- 5. SCOPE OF WORK AND SUPPLY
- 6. MISCELLANEOUS ITEMS
- 7. GENERAL EXEMPTIONS AND CLARIFICATIONS

1. OVERVIEW

1.1. DOCUMENT INTENT

The intent of this document is to define and outline in detail the areas of engineering, design, fabrication, controls, supply, and installation; to whereas this may be the basis for understanding the scope of supply and defining the limits as such.

1.2. GENERAL SCOPE

This technical document covers the design, supply, fabricate, and installation of the following equipment supplied by Gillespie & Powers, Inc. as listed in the accompanying BC-8175 Commercial Proposal.

- 275,000 lb. Multi-Chamber Aluminum Melting Furnace (MCAM)
- Hopper and feed conveyors for Alcoa Vortex Ingestion System
- Supply and installation of Alcoa Vortex Ingestion System
- Supply and installation of Salt Flux Feed System
- Exhaust stack & process interconnection ductwork
- APC System and Ductwork complete with Lime Injection System
- Salt flux delivery system
- Control Room
- Optional Furnace Charge System

1.3. OPERATING ENVIRONMENT

The systems are designed to operate in a typical cast house environment, relatively clean, but unheated. Equipment will be ruggedly built to handle normal plant operations and occasional operator abuse.

Operation design usage:

24 hours per day, 365 days per year

Minimum ambient operating temperature:

10°F

Maximum ambient operating temperature:

110°F

1.4. SYSTEM OPERATION DESCRIPTION

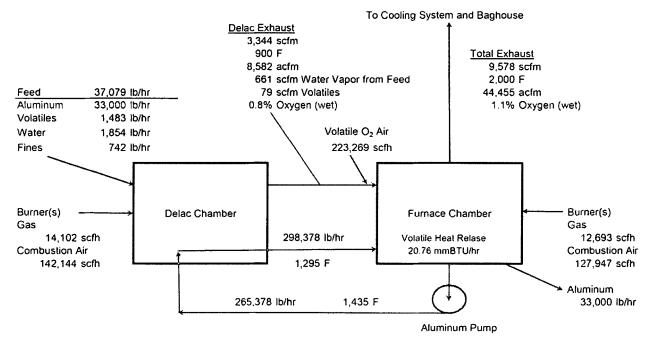
Alcoa has requested the design, fabrication, supply, and installation of a 30,000 lb. per hour Coated Scrap Melting system to supply molten material to crucibles.

The material will enter the furnace via one of two methods. The primary method will be door charge onto a dry hearth area for decontamination. The second method will be via an Alcoa Vortex Ingestion System fed via a conveyance system and hopper.

The Gillespie & Powers, Inc. Multi-Chamber Aluminum Melting Furnace (MCAM) is a unique arrangement of process equipment that provides ideal delacquering of direct charged contaminated scrap aluminum.

The principal components of the G&P MCAM System includes the following: Dry Hearth Chamber; Metal Bath (Heating) Chamber; Molten Metal Pump Circulation System; Volatile Organic Compound (VOC) Eductor System; System Control Damper; and Combustion Control System.

As contaminated scrap is charged in dry hearth chamber the G&P MCAM efficiently captures and uses the VOCs, coming off the contaminated scrap during the delacquering process, as an additional fuel source in the metal bath chamber; lowering the overall furnace's BTU per pound melted.



#1 (Dry Hearth Temperature Control), will have a temperature thermocouple embedded in the hearth roof that will transmit the temperature of the hearth to the main PLC which in turn will control the firing rate of the Dry-Hearth gas-fired burners.

#2 (Metal Bath Chamber Temperature Control), this is a temperature deviant control loop that will compare the deviation of actual temperature of the Metal Bath Chamber roof and the Metal Bath Chamber molten metal bath to their control setpoints. Control Loop #2 will automatically select and control the loop that has the least deviation to its set-point. There-by the chamber roof will protect the metal bath and the molten metal bath will protect the roof and upper walls from overtemp conditions.

A thermocouple will be embedded in the Metal Bath Chamber roof for sensing the temperature of the roof and upper walls. Another thermocouple will be installed in the pump-well to sense the molten metal bath temperature. These T/C's will transmit the temperatures to the main PLC which will control the firing rate of the Metal Bath Chamber gas-fired burners.

#3 (System Pressure Control), this control loop will have a differential pressure transmitter (Delta-P) with a sensing probe through the upper wall of the Metal Bath Chamber approximately 12 inches above the molten metal line. The Delta-P transmitter will transmit a 4-20ma signal to the main PLC which will control the stack damper maintaining the correct system pressure for the furnace.

#4 (Eductor Volatile Flow Control), This loop has two (2) separate sensors, a Hydro-Carbon sensor with its probe embedded on the roof of the Dry-Hearth Chamber, and an Oxygen sensor with its probe located in the flue of the Metal Bath Chamber. The Hydro-Carbon sensor detects the presence of VOCs within the Dry-Hearth Chamber and increases the flow of air to the Eductors to increase vacuum in the dry-hearth. This draws the VOCs from the Dry-Hearth Chamber into the Eductors and exhausting into the Metal Bath Chamber. The Eductors are equipped with ignition burners. The Eductors are designed to rapidly mix the VOCs and the vortex air to create a combustible gas which in-turn creates a heat source for the Metal Bath Chamber.

The Oxygen sensor located in the exhaust flue of the Metal Bath Chamber samples the oxygen level of the waste gasses as they leave the furnace and finetunes the volume of air supplied to the Eductors for the complete VOC destruction. In the event the oxygen supplied by the eductors is insufficient the system will adjust the combustion ratio of the Metal Bath Chamber's burners to allow for additional air, see loop description below.

#5, 6, & 7 (Combustion Ratio), the combustion system for both chambers will be electronic mass flow. Each pair of burners will have flow transmitters installed in the combustion air piping and the natural gas piping to measure the flow of gasses to the burners. Under normal operations these burners will fire at stoichiometric rates. If needed during high VOC conditions the burners in either chamber can be automatically adjusted to an air lean condition to assist in the destruction of VOCs. The PLC will compare the oxygen level and the burner firing rates and adjust the ratio accordingly.

CONTROL DEVICES:

Thermocouple;

- 1. Dry-Hearth Chamber Roof Temperature
- 2. Metal Bath Chamber Roof Temperature
- 3. Metal Bath Chamber Molten Metal Temperature
- 4. Flue temperature
- 5. Dry-Hearth Roof High Temperature limit
- 6. Metal Bath Chamber Roof High Temperature Limit

Sensors and Transmitters:

- 1. Metal Bath Chamber Pressure Transmitter
- 2. Dry-Hearth Chamber Pressure Transmitter, (Data Only)
- 3. Dry-Hearth Chamber Hydro-Carbon Transmitter
- 4. Flue Oxygen Analyzer Transmitter
- 5. Dry-Hearth Combustion Air and Natural Gas Flow Transmitters
- 6. Metal Bath Burner Pair #1 Combustion Air & Natural Gas Flow Transmitters
- Metal Bath Burner Pair #2 Combustion Air & Natural Gas Flow Transmitters

2. QUALITY AND SAFETY

GP emphasizes adherence to the highest standards and level of care during all phases of design and fabrication of its equipment. This carries on throughout installation supervision and commissioning as well as ongoing technical support.

Our objectives are to provide equipment that provides maximum production time with minimum downtime, high energy efficiency, and high safety standards.

This is achieved by integrating quality materials with our custom designs for steel structures, doors, advanced process controls, and combustion systems.

User-friendly designs are incorporated on to all GP systems for servicing and maintaining the equipment. Safety and ease of maintenance is the first and foremost important item in the entire design process and scope for any of our projects. We design our equipment with total safety in mind, from installing man guard where appropriate, exceeding the latest OSHA and NFPA codes, to actively practicing a proactive approach to safety and its execution in the construction environment. We work closely with the Owner's safety personnel to ensure a safe work environment for all personnel. Safety First! Always!

3. GENERAL CODES & STANDARDS

Standard Specifications

All work and material shall be in accordance with this specification and with the latest revision of the following Standard Specifications:

ACGIH American Conference of Government Industrial Hygienists Industrial Ventilation: A Manual of Recommended Practice, 25th Edition

AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
EPA	Environmental Protection Agency
FM	Factory Mutual
IEEE	Institute of Electrical and Electronic Engineer

S NEC National Electrical Code

NEMA National Electrical Manufacturers' Association NFPA National Fire Protection Association

OSHA Occupational Safety and Health Administration

UL **Underwriters Laboratories**

4. CSM SYSTEM

4.1. DESIGN CRITERIA

4.1.1. Furnace

Molten Metal Bath Capacity: 275,000 pounds (based on 148.27 lb/ft³)		
Molten Metal Depth:	36" average	
Free Board:	4" ·	
Dry Hearth Charge Capaci	ty:30,000 pounds (based on 30 lb/ft ³ avg. density)	
Main Bath Surface Dim:	24'-0" x 24'-0"	
Dry Hearth Dimensions:	16'-0" x 24'-0"	
Melt Rate for Coated Scrap: 30,000 lbs/hr		
Molten Metal Temperature: 1400°F to 1460°F.		
Vortex Ingestion Rate:	10,000 lbs/hr (clean lightweight scrap)	
Hopper Capacity for Clean Lightweight Scrap: 15,000 pounds (based on 12 lb/ft ³ density)		

4.1.2. Exhaust Flow

Flows from Sources:	
Fce Waste Gases – High Fire:	69,840 acfm at 2000°F
Fce Waste Gases – Low Fire:	6,984 acfm at 2000°F
Fce Waste Gases – Decoating:	44,575 acfm at 2000°F (average 0 – 6% VOC's)
Main Bath Door Hood:	33,590 acfm at 382°F
Dry Hearth Charge Door Hood:	29,260 acfm at 118°F
Dry Hearth Skim Door Hood:	11,060 acfm at 148°F

Possible Exhaust Combinations:	
Fce. At High Fire:	69,840 acfm at 2000°F
(no doors open)	

Fce. Decoating Mode:	44,575 acfm at 2000°F (average 0 – 6% VOC's)
(no doors open)	

Bath Door Hood and DH Charge Door Both Open:		
Main Bath Door Hood: 33,590 acfm at 382°F		
Dry Hearth Charge Door Hood:	29,260 acfm at 118°F	
Fce Waste Gases – Low Fire: 6,984 acfm at 2000°F		

Bath Door and DH Skim Door Both Open:		
Main Bath Door Hood: 33,590 acfm at 382°F		
Dry Hearth Skim Door Hood:	11,060 acfm at 148°F	-
Fce Waste Gases – Low Fire:	6,984 acfm at 2000°F	

4.2. SUMMARY OF COMPONENTS & DESIGN FEATURES

4.2.14. General Design Features

Furnace Type:	Dual Chamber Coated Scrap Melter
Gross Molten Capacity:	275,000 pounds (based on 148.27 pcf)
Transfer Capacity:	90,000 pounds (±10 ½" draw down)
Metal Heal:	185,000 pounds
Metal Depth:	36" average
Melt Rate:	30,000 lbs/hr
Number of Doors:	3
Dry Hearth Door Clear Opening:	7'-2" x 20'-0"
Bath Chamber Door Clear Opening:	8'-0" x 20'-0"
Clean Out Door Opening:	7'-2" x 8'-0"
Jamb & Lintel Construction:	Cast-in-place refractory
Sill Construction:	Replaceable heavy steel plate skim shelf
Door Actuator:	Electric motor & gear box
Main Bath Chamber Ramp Angle:	27° slope
Dry Heath Chamber Ramp Angle:	45° slope
Free Board:	4"
<u> </u>	

4.2.15. Steel Structure

Casing Construction:	Standard mild steel construction
Wall Plate Thickness:	1/2" plate
Floor Plate Thickness:	5/8" plate
Floor Plate Splices:	5/8" x 6" bar
Floor Beam Size:	TS6 x 4 x 3/8" tube
Floor Beam Spacing:	18" maximum
Vertical Buckstay Size:	W10 x 26
Vertical Buckstay Spacing:	34" maximum
Horizontal Wrap Stiffener Size:	C10 x 15
Horizontal Wrap Stiffener Spacing:	Top of casing, Full metal level, & Mid- Bath Level
Roof Beam Sizes:	W12 x 45, W8 x 18
Lintel Roof Header Beam:	W18 x 86, MC18 x 58
Seal Welding Level:	Water tight to 12" above full metal level
Painting:	Per Alcoa Specifications

4.2.16. Refractory

Floor Hot Face:	13 ½" Allied Minerals Matriflo 85 ACX
Intermediate Floor:	9 ½" average Vesuvius Alugard H&B
Floor Insulation:	6" H&W Greenlite 45-L AL
Lower Side Wall Hot Face:	18" Allied Minerals Matriflo 85 ACX
Lower Side Wall Insulation:	2" Thermal Ceramics Superwool 607 Bd
Upper Side Wall Hot Face:	15 ½" H&W Versa-Tech 55 AR HS Plus
Upper Side Wall Intermediate:	2" Thermal Ceramics TR-19 Block
Upper Side Wall Insulation:	2 ½" Fibrex 1900 Block Insulation
Roof Hot Face:	12" H&W Versa-Tech 55 AR HS Plus
Roof Insulation:	3" Vesuvius Lite Wate 20/35
Flue Hot Face:	9" H&W Versa-Tech 55 AR HS Plus
Flue Insulation:	1 ½" Fibrex 1900 Block Insulation
Dry Hearth & Ramp Hot Face:	Vesuvius Alugard RHB
Door Hot Face:	9" H&W Kast-O-Lite 30 LI
Door Insulation:	2" Fibrex 1900 Block Insulation
Door Perimeter:	Adjustable Maftec Fiber Modules
Burner Ports:	H&W Plastech 85P
Sills:	Vesuvius Alugard RHB
Jambs & Lintels:	Allied Minerals Armormax 70 SR w/ SS Fibers

4.2.17. Combustion & Control System

Burner Manufacturers:	Bloom Mfg. & Eclipse
Qty. Burners Main Bath Chamber:	Four (4)
Qty. Burners Dry Hearth: Two	0 (2)
Qty. Burners Eductors:	Four (4) total – two (2) per eductor
Main Bath Chamber BTU Input:	64 x 10 ⁶ BTU/Hr total
Dry Hearth Chamber BTU Input:	12 x 10 ⁶ BTU/Hr total
Eductor Burner BTU Input:	2 x 10 ⁶ BTU/Hr total
Fuel:	Natural Gas
Fuel Delivery Pressure:	25 psig minimum / 100 psig maximum
Electric Power:	480/3/60 (primary) / 120/1/60 (control)
Pilot Type:	Natural Gas
Burner Turn-Down Ratio:	5:1
Main Bath Blower Capacity:	840,000 scfm estimated

Main Bath Blower HP:	100 HP estimated
Dry Hearth Blower Capacity:	300,000 scfm estimated
Dry Hearth Blower HP:	50 HP estimated
Eductor Blower Capacity:	TBD
Eductor Blower HP:	TBD
Blower Pressure:	24" wc
Blower Air Source:	Fresh air from outside building
Main Gas Safety Latch Valve:	FM approved / TBD
Main Gas Solenoid Vent Valve:	FM approved / TBD
Main Gas Pressure Regulator:	Fisher
Main Air control Valve Type:	None linear butterfly
Main Gas/Air Safety Press. Switches:	Honeywell or equal
High Temperature Limit:	Honeywell
Flue Damper Type:	Mechanical
Flue Damper Actuator:	Electronic (Beck, Siemens or equal)
Flue Pressure Transmitter:	Honeywell / Rosemount
Air/Fuel Ratio Control Type:	Mass Flow
Pre-packaged Gas Valve Train:	Includes all necessary valves
Fabricated Control Enclosure:	Hoffman Type NEMA 12
Furnace Control PLC:	Allen-Bradley ControlLogix L557 w/
	Ethernet
Furnace HMI:	Allen-Bradley PanelView Plus 1000

4.2.18. Auxiliary Support Equipment

4.2.18.9. Alcoa Vortex/Pump System, including:

- Precast components
- Pump assembly with impeller
- Electric drive package

4.2.18.10. Molten Metal Transfer System, including:

- Five Pyrotek T-35-T Pumps (One primary pump, one backup pump, and three spares with stands.
- Two electric drive packages
- Pump supports, trolleys, hoists
- Launder to fill crucible

4.2.18.11. Simplex Fire Protection System for both Furnace and APC equipment

4.2.18.15. APC System

4.3. DESIGN FEATURES

4.3.1. Main Doors

The Main Bath (Heating) Chamber will have one skim door opening with a vertical lift. The Dry Hearth will have two doors. One large door will be on the East end and a smaller Skim Door on the North for access to the internal side well. The doors will be refractory lined with robust structural steel frames. Door lining will be light weight castable with backup insulation and adjustable fiber perimeter seal.

The Main Bath Chamber door openings will be approximately 7'-2" high by 20'-0" wide. The large Dry Hearth door opening will be approximately 8'-0" high by 20'-0" wide. The Skim door will be 7'-0" high by 8'-0" wide.

The door lifting systems will be electric motor and gear-box operated, complete with guards, rollers, heavy duty roller chain, bearing blocks, and shafts. The door opening time will be approximately 20 to 30 seconds. The doors will be operated by a manual station mounted near each of the door openings. The doors will also have remote operator devices (3 included) that will be capable of operating all three doors.

The doors will have 6" overlap on the sill, 9" overlap on the jambs and 101/2" overlap on the lintel. The door opening faces will be have a 5° slope from vertical.

4.3.2. Casing and Steel Structure

General:

The description below of the steel casing, represents the minimum design. The fabricated and installed steel structure may vary from this during engineering and discovery.

The furnace is encased in a fabricated steel plate, bound and reinforced with structural shapes to resist buckling and warping and to support the various furnace refractories and mechanical components.

The furnace casing openings will be reinforced with a second 1/4" minimum steel plate and appropriate structural members at the following openings; burner mounts, flue, door, and test port; and where possible shall have rounded corners to relieve converging stress points.

All casing splices will be fitted with a fully welded full thickness doubler plate with large overlap allowance; 8X plate thickness per side.

The melter steel casing shall be 1/2" mild steel plate for the walls and 5/8" mild steel plate for the floor. All floor splices shall be full welds with a 5/8" doubler plate. The floor beams shall be TS6 x 4 x 3/8" tubes on a maximum 18" centers. Along the side walls, the vertical buckstays shall be W10" beams on a maximum of 36" centers. Wrap around C10" channels shall be located at the top of the steel casing at full metal level location and at mid-bath metal level location.

The structural roof beams shall be W12", W8" and MC18" beams. The refractory roof shall be supported by S3 x 5.7 beams.

The Metal Bath (Heating) Chamber and the Dry Hearth Chamber shall be separated by a common steel division wall. This wall will be air cooled by an independent blower that shall cool both the division wall and the floor steel.

4.3.3. Refractory

4.3.3.1. Hearth

Refractory in the hearth shall consist of appropriate hot face, sub-hearth, and backup insulation materials, considering impact loading, thermal cycling, and longevity. Floor shall be sloped 1-1/2" over 10' toward pump well and drain hole to ensure proper drainage of furnace to dry hearth during shutdown. (If this furnace will require a drain block, the same slope shall be designed for it.) Joints between sub-hearth layers and side wall shall be keyed together. Weep holes (3/4" size) for wicking ropes shall be placed in the side walls on 24" centers.

Main Bath Chamber Hearth refractory shall be as follows:

- Hot Face: 13 1/2" Allied Mineral Matriflo 85 ACX
- Sub-hearth: 9 1/2" (average) Vesuvius Alugard H&B
- Sub-hearth insulation: 6" HW Greenlite 45-L AL
- Total average thickness 27" (2'-5")

Dry Hearth Chamber Hearth refractory shall be as follows:

- Hot Face: 13 1/2" Vesuvius Alugard RHB
- Sub-hearth: 9 1/2" (average) Vesuvius Alugard H&B
- Sub-hearth insulation: 6" HW Greenlite 45-L AL
- Total average thickness 27" (2'-5")

Upper side wall refractory shall utilize appropriate materials for non-metal contact service temperatures to maximum 2150°F, with additional consideration for refractory near burner flame and flue transition, and repeated mechanical abuse from charging prime ingot and scraping/stirring operations. Lower wall material should extend 18" above metal line.

Sufficient refractory footer of appropriate material shall be provided to support side wall installations. Tap hole refractory shall be sufficiently sealed to prevent leaks, able to be cleaned, and maintainable should issues occur.

4.3.3.2. Walls

Areas in lower walls deemed necessary to cast or ram in place shall be appropriately keyed and anchored, with appropriate selected material for upper wall or lower wall applications. Areas near door jamb not pre-cast but exposed to cycling thermal stress shall be keyed and anchored.

Provisions shall be made in side wall linings for tap hole block, drain hole block, pressure port, bath thermocouple block, burners, and flue, with appropriate consideration to operating temperatures, thermal cycling, erosion, and

maintainability. Weep holes/wicking ropes (3/4" size for ½" rope) shall be places in lower wall on 24" centers.

Lower Wall refractory shall be as follows:

- Hot Face: 18" Allied Minerals, Matriflo 85 ACX
 - Insulation: 2" Thermal Ceramics Superwool 607 Board
- Total thickness 20" (1'-8")

Upper Wall refractory shall be as follows:

- Hot Face: 15 1/2" Harbison Walker Versa-Tech 55 AR HS Plus
- Intermediate Insulation: 2" Thermal Ceramics TR-19 Block
- Insulation: 2 1/2" Fibrex 1900 Block Insulation
- Total thickness 20" (1'-8")

4.3.3.3. Roof

Roof castable installation shall be minimum 12" layer on hot face with 3" layer of insulating roof castable on cold face. Expansion joints shall be provided for expansion in all directions. All joints shall be keyed.

Internal roof elevation shall provide for the necessary volume for combustion as well as for easy access for skimming, stirring and charging with Buyer's equipment.

Expansion joints shall be provided for expansion in all directions. Roof shall be divided into sections using aluminum divider that will act as an expansion joint. The refractory anchor system for the roof shall consist of anchor brick (Snowshoe) only, WP-85 roof anchors, 3" S-beams, and R-42 beam clamps.

Roof refractory shall be as follows:

- Hot Face: 12" Harbison Walker Versa-Tech 55 AR HS Plus
- Insulation: 3" Vesuvius Lite Wate 20/35
- Total thickness 15" (1'-3")

4.3.3.4. Flue

The flue will be sufficiently sized to evacuate the highest temperature products of combustion from the furnace with moderate velocity affecting exhaust system pressure drop and detrimental refractory erosion. The flue hot face material shall be Harbison Walker Versa-Tech 55 AR HS Plus to withstand elevated continuous 2300°F exposure, with Fibrex 1900 Block backup insulation. The flue damper should also be insulated to withstand continuous elevated temperatures (2300°F).

4.3.3.5. Ramps, Sills & Dry Hearth

The Main Bath Chamber shall have small sill for skimming furnace. Inside the sill shall be a 27° (6" rise to 12" run) ramp which slopes down to floor (hearth) refractory.

The Dry Hearth Chamber shall have a large elevated dry hearth for accepting charged scrap. At the base of the dry hearth shall be a 45° ramp sloping down to the internal well floor. The skim door on the north side of the Dry Hearth Chamber shall have a small sill for skimming the well bath and 45° ramp.

The ramps, sills and dry hearth shall be designed to withstand repeated charging of scrap as described in this specification, skimming, scraping, and stirring operations, exposure to high fire flame temperatures (not impingement), and continually variable molten metal bath elevations.

The sills shall be designed to withstand thermal cycling and repeated abuse. The sills shall be designed to allow skimmed dross to drain metal back to bath before it is removed from the furnace. Final dimensions of sill and ledge shall be reviewed with Buyer engineer prior to design completion and material purchase. The sills will include replaceable heavy steel skim shelves with a 1½" minimum thickness front steel skim shelf plate. The design will allow for periodic replacement in order to maintain proper door seal.

The hot face material for the ramps, sills and dry hearth shall be Vesuvius Alugard RHB cast in place.

4.3.3.6. Doors

The doors will have an adjustable fiber perimeter seal, approx. 8" wide and 12" thick to be adjusted with jack bolts. The center of the door linings will be 9" Harbison Walker Kast-O-Lite 30 LI lightweight castable with 2" Fibrex 1900 Block backup.

4.3.3.7. Jambs & Lintels

The jambs and lintels will be Allied Mineral Armormax 70 SR castable with stainless fiber reinforcing. The jambs and lintels will provide the sealing surface for the door.

4.3.4. Flues, Damper & Exhaust Duct

A properly positioned furnace flue will be supplied with a refractory lining and will extend up to the pressure control damper. The flue will be sized for the products of combustion at high fire and for furnace purging mode.

Furnace Combustion System and Controls 4.3.5.

4.3.5.1. Combustion System

Bloom Engineering Low NOx Cold Air Burners shall be installed in the Metal Bath (Heating) Chamber and the Dry Hearth Chamber. Four 14" Medium Velocity natural gas burners will be installed in the Metal Bath (Heating) Chamber, the burners are rated at a maximum input of 16MM BTU/hr each, 64MM BTU/hr total. Two 10" Velocity natural gas burners will be installed in the Dry Hearth Chamber, the burners are rated at a maximum input of 6MM BTU/hr each, 12MM BTU/hr total. Four small natural gas burners will be installed (2 each) in both of the Eductors, the burners are rated at a maximum input of 0.5MM BTU/hr each, 2.0MM BTU/hr total. Each burner shall include a spark ignited pilot, and full flame supervisory management. The gas/air ratio will be controlled by an electronic mass flow system. All necessary combustion gas and combustion air components will be supplied to make a fully complete and NFPA approved operational combustion system. The burners will be located to maintain proper metal temperature during casting and to allow for the greatest retention time for the products of combustion.

Power isolation will be provided for independent control and maintenance. The 120VAC/24VDC control panel shall be a NEMA 4 enclosure complete with relays, lights, pushbuttons, selector switches, Honeywell UDC-2500 high temperature limit, purge limits, main combustion limits, single fuel, Honeywell 7800 series ultraviolet self-checking independent flame supervision for each burner, with pilot ignition. The control panel will have a hard wired high temperature and pre-purge safety limits for the combustion chamber and a hard wired solid state watchdog timer for the PLC. The PLC shall have 10% spares available for future expansion. The control system will also have 2 zones of temperature control with roof/bath cascade in the Heating Chamber, furnace pressure control, and 2 high temperature limits. The system will use Pilot Relight to enable low fire operation with pilots only. This system incorporates a PLC (programmable logic controller) with associated I/O (inputs and outputs), and Operator Interface (HMI). The system will conform to the latest NFPA standards. See below description for programmable controls.

The combustion system will be designed to utilize burner pulse firing and return to pilot features. This allows for improved burner turndown and greater distribution of heat when low BTU input is required. Once the BTU requirement is below 5% and the temperature heat demand is zero the system will return to pilots only. This type of arrangement will help decrease total gas consumption and reduce temperature over-shoot.

The combustion will employ an outside air supply for the combustion air blowers.

4.3.5.2. Temperature Controls

The Heating Chamber of the furnace will be supplied with a dual loop, Type K

thermocouple controller with a cascade control programmed for the roof temperature and the metal bath temperature. The controller will be a part of the combustion PLC control system with a 4-20 mA analog output for the field combustion system control device(s). The Dry Hearth will be controlled from a Type K thermocouple located in the upper walls of each chamber.

Also, incorporated into these controls will be the furnace door open switches to drive the burners to low fire when a door is open

4.3.5.3. PLC & Panel Components

- Allen-Bradley ControlLogix L557 series PLC.
- Proposed system to include the following communications modules:
 - (1) Ethernet communication for internal plant communications
 - (1) Ethernet communication for PanelView interface 0
 - Ethernet switches Stratix 5700.
- All I/O shall be low voltage 120V
- All programs to be provided in the latest version of RSLogix 5000.
- Electrical Controls System:
 - Allen-Bradley ControlLogix L557 PLC. 0
 - Ethernet communication cards. 0
 - Used fused Output IFM Modules where applicable. 0
 - PLC Chassis (number of slots TBD) 0
 - Operator Interface use Allen-Bradley PanelView Plus 1000 0 with Ethernet Communications
 - (1) Extra 8 point Thermocouple card, for floor temp readings. 0
 - Over temperature Controller Honeywell 2500. 0
 - PLC Control Panel shall be a minimum 18" deep. 0
 - Flame Safety Components Honeywell Flame Relay RM7890 0
 - Flame Relay base Amplifier Cat. 0
 - Keyboard Display. 0
 - Self-Checking Flame Detector. 0
 - Solid State PLC watchdog timer. 0
 - Supplementary Over current Circuit Breakers. 0
 - Power Supplies shall be Sola SDN Series 0
 - PLC Panel shall include one 20-amp GFCI rated receptacle. 0
 - Phoenix type color-coded terminal blocks shall be used in all 0
 - Provide 10 percent spare terminals for future expansions. 0
 - Emergency Stop Push-Button Allen-Bradley No. 800H-0 PRM16R.
 - All Push-Buttons, Pilot Lights and Selector Switches shall be 0 Allen-Bradley Type 800H Series.
 - Grounding Bars shall be installed in all panels and terminal 0 boxes.
 - NEMA 12 type panel enclosure. O
- **HMI Screen Additions**
 - (1) Screen for display of the floor thermocouples.

Startup and monitoring of the floor cooling blower.

4.3.5.4. Operator Control Booth

An operator control booth shall be supplied to contain all necessary operator interface equipment to monitor and control the furnace system. The booth shall be of a pre-fabricated steel building design that can be moved by fork truck or overhead crane. It shall be provided with all furnishings and accoutrements identified in the Customer's RFQ.

4.3.5.5. Motor Control Center

The furnace motor control center shall be an Allen-Bradley IntelliCenter with It will contain a main fused disconnect switch, control power transformer, control power distribution panel, power feeders, motor starters and VFD's.

An MCC building shall be provided and shall be capable of being installed by either fork truck or overhead crane. The building will be divided into compartments (rooms) so that, in addition to the MCC, the fire detection and suppression system may also be housed in it.

4.3.6. Alcoa Vortex/Pump System

Gillespie & Powers will supply and install the Alcoa Pump and Vortex System. The system shall be employed to move metal for the Main Bath (Heating) Chamber to the internal well in the Dry Hearth Chamber. The system shall also be employed to ingest lightweight clean scrap in the vortex bowl. The system shall be provided complete with all precast shapes, impeller, electric drive system, and fume hood.

4.3.7. Molten Metal Transfer System

The furnace will have a transfer pump well for the transfer of molten metal into open-top crucibles through a short launder. The pump shall be capable of transferring 10,000 pounds of molten metal in 2 minutes into an open-top crucible. The well will hold two pumps; a primary pump and a backup pump. The pumps and associated controls and equipment will be supplied by Gillespie & Powers. Supply of three spare pumps and stands is also included in this proposal.

4.3.8. Furnace Drain

The drain will be located at the low point of the furnace floor, and at an available location for a crucible pit that will have overhead crane access. The drain will incorporate the standard Alcoa drain block and pneumatic plugger.

4.3.9. Fire Protection System

A fire protection system designed by Alcoa approved subcontractors shall be supplied and installed.

4.3.10. Painting

We will paint all parts requiring protection before delivery to site in accordance with Alcoa Engineering Standards 333.218.2 and 33.218.8.

4.3.11. Shop Assembly

We would preassemble and partially carry out electrical wiring on the apparatus in our Works or at Sub-contractor's Works as complete items and carry out certain cold tests prior to packing for shipment.

4.3.12. Foundations

We will provide a drawing indicating foundation requirements, loads, positions of services, etc.

The customer will be responsible for the design, supply and installation of the foundation and all foundation work (including all embedded steel and anchor bolts).

4.3.13. Charging Machine (Optional)

As an option Gillespie & Powers is proposing to furnish the complete designed, supply, and installation of the RIA Charging Machine.

- Supply, deliver and Install the designed equipment consisting of:
 - o Travelling-Frame
 - Intermediate-Frame
 - Intermediate-Frame with Upper-Carriage-Drive
 - Upper-Carriage with Pusher-Drive
 - Pusher
 - E-Cabinet
 - Laser Scanner
 - Weighing Device
- All necessary Piping & Wiring to the customer supplied utilities
- Start-up & Training

4.2.13. Uncoated Scrap Feed Conveyor

As an option Gillespie & Powers is proposing to furnish a conveyor system to feed uncoated scrap to the Alcoa Vortex System at a rate of 10,000 lb/hr. The conveyor system to be supplied and installed shall include the following components complete with drives, guards, skirts and necessary components:

- 60" wide x 36'-5" long steel belt conveyor
- 60" wide x 46'-6" long welded tube steel belt conveyor
- 48" wide x 19'-0" long flat belt conveyor with belt scale
- 48" wide x 14'-7" long vibratory feeder

4.3.14. Salt Feed System

The Gillespie & Powers, Inc. Aluminum Furnace fluxing salt conveyance system will be designed for the Alcoa requested method of delivery and capable of feeding salt into the vortex at a rate of 3% of the scrap feed. Per Alcoa the fluxing salt will be delivered by dump truck to a floor hopper. The floor hopper will be of sufficient size to hold 21 cubic yards of fluxing salt, (1.5 average dump truck loads). The top of the hopper to be at floor level. The top of the hopper will be covered with walkway grating capable of supporting the weight of workers but allow the fluxing

salt to pour through.

The "Fluxing Salt Hopper" will be equipped with a bottom auger and rotary discharge airlock to discharge the fluxing salt into the "Pneumatic Silo". The Pneumatic Silo will be equipped with a "loss of weight" scale that will control the airlock and auger for filling and refilling the silo. The auger will be used to break-up salt clumps for even flow into the rotary airlock. The fluxing salt hopper will also be equipped with side wall pneumatic vibrators to ensure that bridging of the fluxing salt does not occur.

A "Pneumatic Conveyance Tube System" will be supplied for conveying the fluxing salt from the Pneumatic Silo to the "Day Bin Hopper" located at the aluminum scrap vibrating bin hopper that feeds the scrap aluminum into the vortex well. The Day Bin Hopper will be equipped with a "weight gain scale" that will control the pneumatic conveyance system for filling and refilling the Day Bin Hopper and metering into the furnace.

From the Day Bin Hopper the fluxing salt will be augured into the vortex well at a metered rate to satisfy the scrap aluminum melt rate. A melt rate vs fluxing salt feed rate study will need to be performed during runtime conditions to calibrate the auger speeds for the desired scrap feed.

The pneumatic system conveyance system will be complete from the Floor Hopper to the Day Bin Hopper with all controls, electrical and pneumatic parts and hardware.

4.3.15. APC System

Gillespie & Powers will provide an APC System for handling waste gases from the furnace flue and external fume hoods at the three furnace doors. We are currently intending to purchase this system from Entecco Filter Technology. The system will consist of the following.

4.3.15.1. Jet Pulse Baghouse Filter

Quantity:	5 Module Pulse Jet Baghouse	
Type:	JDR 1505-6000-10-16-SV	

Baghouse filter with vertically installed filter elements cleaned with compressed air, industrial design. Extremely high filter quality with constant, high suction power.

Controlled on-line cleaning with lowest compressed air consumption with compressed air jet pulse per LHS standard with flow-through valves in filter head. Panel filter with inspection cover in filter head for installation and removal of filter elements on clean gas side.

Technical data:

• Flow:	70,000 Aft³/m at 320°F
Dust type:	aluminum oxides and lime
Raw gas load:	50-100lbs/hr.
Clean gas value:	.001001 grains / DSft3
Filter medium: Aramide with olections	phobic hydrophobic coating
Filter bag length:	20 ft
Filter medium diameter:	6.30 inches
Number of filter elements:	750 bags
Filter area:	25,108 ft²
Air to Cloth Ratio:	2.79:1
Air to Cloth with One Module offline:	3.49:1
Support cage design:	10 longitudinal rods
Support cage material:	Steel, coated
Compressed air demand:	max. 70 Cfm
Compressed air pressure:	90 psi
Filter housing design:	10 ga sheet steel
Positive / negative pressure:	max. ± 22"

4.3.15.1.1. Filter Accessories:

•	Filter control unit:	Continuous time-controlled or differential pressure-controlled cleaning, LCD display, 4-20 mA output signal, IP65
•	Compressed air combination:	Compressed air control valve with pressure switch and safety valve, IP65
•	Heating:	230V, frost protection for cleaning valve control unit
•	Stairs:	Stair System to get to top of plenum
•	Protective railings:	Railing in sectional steel on the filter head with handrail, knee and foot bars per Alcoa Specs
•	Noise suppressing hoods:	Galvanized hoods with noise suppressing cladding on the compressed air tank

4.3.15.1.2. **Dust Collection Tray:**

Quantity	y: 1 pcs		 	
Type:	JDR 1505-10			

Dust collection tray for collecting the separated dust, in weather-proof design with maintenance opening for inspection.

Design:

Dust collection tray:	10 ga. bolted sheet steel, precision laser cut and folded
Tray angle:	60°
hopper height	10 ft

4.3.15.1.3. Filter Support Structure:

Quantity	/: 1 pcs	· -		 		
Туре:	JDR 1505-08				- "	

Galvanized filter support structure dimensioned for medium loads. Structural calculations carried out without earthquake factor, support height: 6,000mm.

4.3.15.1.4. Dust Collection Hopper

Quantity: 5	pcs		
Type:	JDR 1505-02		

Dust collection hopper for collecting the separated dust, in weather-proof design with maintenance opening for inspection.

Design:

•	Dust collection hopper:	10 ga. bolted sheet steel, precision lase cut and folded
•	Hopper angle:	60°
•	Hopper height:	9'-6"

4.3.15.1.5. Maintenance Platforms and Stairs

Quantity: 1	pc	
Type:	JDR 08	

Maintenance platform with grating and protective railings including: handrail, knee and foot bars, and stairway approximately 50 ft.

4.3.15.2. Raw Gas Duct

Quantity:	1 pc	
Type:	JDR 1505-10	

Welded, horizontal aligned raw gas duct with inspection hatch and the necessary fittings for optimized raw gas flow. With connection flange to the raw gas duct system and to the filter.

Design:

•	Raw gas duct:	8 ga. welded sheet steel, precision
		laser cut and folded

4.3.15.3. Connection Shaft for Raw Gas Channel

Quantity:	1 pc	
Туре:	JDR	

Welded connection shaft for the raw gas channel with flanges on the interfaces.

Design:

•	Connection Shaft:	8 ga. welded sheet steel, precision
		laser cut and folded

4.3.15.4. Clean Gas Duct

Quantity:	1 pc	
Type:	JDR 1505-10	

Clean gas duct horizontally aligned with connection flange to the filter and the clean gas duct system.

4.3.15.4.1. Clean Gas Outlet Hoods

Quantity:	1 pc				
Туре:	JDR			 	

Galvanized clean gas outlet hoods with connection flange to the filter. Direct

4.3.15.4.2. Wear Protection HARDOX

Quantity:	1 pc			
Type:	JDR			

5mm HARCOX wear protection at raw gas entry in top tray area.

4.3.15.4.3. Baffle Plate HARDOX

Quantity:	1 pc			 	
Туре:	JDR	_			

5mm HARCOX baffle plate at raw gas entry to protect the filter bags.

4.3.15.4.4. Filter Separating Wall

Quantity:	1 pc	
Type:	JDR 1505-6000	

Division of filter raw gas chamber into two separate units.

4.3.15.4.5. Heating for Filter Control & Compressed Air Combination

Quantity:	1 pc		

Heated cabinet for the local filter control and the compressed air combination, 230 V, to -25°C.

4.3.15.5. Rotary Valve

Quantity:	6 pcs	
Type:	ZNL030-250	

for discharging of separated dust.

ACS Model CI 8x8, 0.20 C.F.R. Rotary Airlock Valve complete w/ operator, zero speed switch, & epoxy coated rotary pockets

Technical data:

•	drive:	1-2 hp 20rpm; SEW
•	throughput:	approx. 11 ft³/m at 100% filling level
•	inlet/outlet:	8 inches x 8 inches
•	height:	14 inches
•	housing:	in 1.0038
•	sealing:	reinforced rubber lips / PTFE / VA, replaceable

4.3.15.6. Control Cabinet for Filter SA

Quantity:	1 pcs		

4.3.15.6.1. **Baghouse MCC**

(1) Main Lug only MCC				
(1) 300Hp Combination Soft Start for ID fans				
Combination motor starters for:				
o (5) baghouse rotary air locks				
o (1) lime rotary air lock				
o (1) lime blower				
o (1) lime feeder				
o (1) Silo vibrating bin bottom				
o (1) silo bin vent				
o (2) cooler blowers				
o (1) cooler screw conveyor				
o cooler air lock				
Silo A C, and De-humification system				

5KVA control transformer and 120V distribution breaker panel

4.3.15.6.2 One Main PLC Control Panel and (1) Remote I/O control panel. All Completely pre-wired to terminal blocks with the following components:

- (1) Set of incoming 110V fuses, 110V will come from lighting panel located in MCC
- (1) Master Control relay
- (1) Allen Bradley PLC with necessary power supply, I/O cards and Ethernet communications. All I/O cards will be located in the PLC control panels.
- All necessary piloting devices.
- (1) Allen Bradley 15 Inch HMI, HMI will display
 - o ID fan currents
 - o Baghouse differential pressures
 - o Baghouse Inlet and outlet temperatures
 - o Air Pressure
 - o Broken Bag alarms
 - o Status of motors running
 - o Local starting of motors
 - o Cleaning cycle on/off
 - o All Cleaning Damper positions (open/closed indication)
- Smoke detector included to be tied into Alcoa Plant Simplex system

4.3.15.6.3. Field Devices

- (1) Static Pressure transmitter
- (1) air pressure switches
- (2) Thermocouples
- (5) Hopper level probe per Alcoa Specs
- (2) discharge dust bag high level switch
- (1) 20 Foot Connex Control Room with, AC, lighting, receptacles and insulation

4.3.15.6.4. Engineering Services

 Panel layout drawings with bill of material Panel Schematics Control schematic I/O card details Installation block diagram with raceway and wire sizing · Conduit bank layout for the underground conduits Ground grid layout drawing PLC control program to properly sequence and control the baghouse

If installed outside, the cabinet is to be equipped with rain shield (to be provided by customer).

All net, motor, and control cable are directly wired to the frequency inverter. Control cabinet completely assembled and wired.

4.3.15.7. Field Instruments

system

Quantity:	1 Pc		 	
Probes and	sensors for	measurement of:	· · · · · · · · · · · · · · · · · · ·	

, De a	and sensors for measurem	CITE OI.
•	Pressure:	at melting furnace, in raw gas line for frequency inverter application, detection of leakage
•	Temperature:	of raw gas after SO and TNV, manifold in front of axial spin separator, dust collection hopper, at bearings of main radial fan
•	differential pressure:	in filter unit
•	end position:	of cleaning system
•	zero speed/speed/rotation	at discharge components
•	vibration:	at main radial fan
•	level:	of dust in dust collection hopper, big bags, residue silo

Thermal Insulation

Quantity:	1	pcs
		nsulation for:
•		o filter inlet hood
		o filter middle part
		o hopper
		o screw
	• fc	or external surfaces of the following components:
•		Metal Cladded
_		o 4" thick
	• C	onsisting of:
•		o Mineral Wool Mats – 4" thickness
		Cladding from aluminum plates – 1mm thickness

Trace Heating

Quantity:	1 pcs		

Trace Heating for Hopper, screw, and Rotary Air Lock

Module Isolation Dampers

Quantity:	10 pcs		

damper on inlet of each of the (5) modules and inlet on the outlet of each of the (5) modules

Technical data:

- housing in welded mild steel (no. 1.0038)
- internal damper blade, rotatable incl. leverage system
- motor-driven / pneumatic servo drive with initiator and hand wheel

Fresh Air Damper

Quantity:	1 pcs
Type:	59 Inch x 14 Inch

to protect the filter from excessive heat (located at the inlet to the raw gas inlet hood).

Technical data:

- housing in welded mild steel (no. 1.0038)
- internal damper blade, rotatable incl. leverage system
- motor-driven / pneumatic servo drive with initiator and hand wheel

Safety Damper

Quantity:	1 pcs			
Type: 1500	x 350		_	

to protect the filter modules from excessive heat (located at the inlet to the raw gas inlet hood).

Technical data:

- housing in welded mild steel (no. 1.0038)
- internal damper blade, rotatable incl. leverage system
- motor-driven / pneumatic servo drive with initiator and hand wheel

4.3.15.13. Fan & Motor

Quantity: 1 pc

Fan & Motor for above specification

- 70,000 ACFM at 16" t.s.p.
- 360 F at 377 ft above sea level

Clean Gas Ducting & Stack

1 pcs Quantity:

Clean gas ducting to connect filter to fan to stack

Stack to be of proper size and height to acceptably emit treated gas stream to atmosphere

Hydrated Lime Silo

Quantity: 1 pc

- (1) 12' OD x 22' Cylinder height (40' overall height), Skirt supported silos with approximately 2,700 cubic foot of capacity. Each silo to include the following:
- (1) 10° Sloped roof
- (1) 60° Cone to dual 4' flanged outlets
- (2) Primary lifting lugs
- (1) Base ring
- (1) 24" Roof manway w/PVR
- (1) Bolted target box 4" inlet & 6" cleanout
- (2) Sensor openings (cyl)
- (1) 18" Square flange (Skirt fan)
- (1) 6" Plate flange (roof)
- (1) 6' x 6'-8" Double door w/louver

• (1) Lot 4" Sch. 40 fill line w/brackets
• (1) 4" Iron truck fill adapter w/cap
• (1) 36"x48" Bin Vent flange
• (1 (F) Galvanized top railing w/ angle posts & painted steel toe board TC standard)
• (1) Galvanized steel ladder w/cage (PTC standard)
• (1) pulse jet bin vent filter with dehumidifier
• (1) humidity sensor in silo
• (2) humidity sensors in skirt
• (1) skirt installed insulation
• (1) Skirt installed air conditioning unit

Additive Feeding System

Skirt installed dehumidifier

Quantity:	1 pc			
guaritity.	1 00			

for feeding and pneumatically conveying additives into the raw gas system.

Consisting of:

- supply of additive with a high-pressure blower system 15hp.
- includes 22kW heater for fan inlet so that the inlet air to the pump is pre-heated before conveying
- 35 ft³-Flow-Bin / Big-Bag holding unit with vibration plate
- · steel construction for additive supply and additive feeding
- rotary valve for the filling of hopper
- 26 gallon hopper with feeding unit and jogging motor
- · monitoring/controlling by weighing cell / level measuring

Feeding unit - technical data:

- feeding range depending on model: 25lbs 50lbs/hr
- frequency-controlled drive of screw feeder
- · screw feeder in full-face shaft
- motorized disaggregation unit

Conveying fan - technical data:

•	air flow:	25 ft³/min
•	pressure:	30"

Miscellaneous:

- conveying hose as flexible spiral hose: NW100 (length: 30 ft)
- fastening and sealing material

Spark Arrestor – Static Mixer

Quantity: 1 pc

Spark Arrestor to help prevent sparks from entering the baghouse. Also used for the intensive mixing of additive and raw gas

Includes:

- mixing blades
- fastening
- sealing material

Technical data:

- in heavy-duty welded design (no. 1.0038)
- sheet thickness: 10 gage

4.3.15.14. Surface Treatment

Per Alcoa Specs.

Standard color for temperatures up to 200 °C: silver grey (RAL 7001) Standard color for temperatures above 200 °C: grey aluminum (RAL 9007) Deviations in terms of color may occur, if different kinds of paint are applied.

Sheet steel: mild steel degreased and pickled

Profiles: shot blasted according SA 2.5

Excluded from this standard are purchase components, i.e. motors, parts in special steel as well as galvanized or insulated surfaces.

4.3.15.15.

Fastening and Sealing Material

Quantity: 1 set

for the assembly of filter plant and steel construction.

4.3.15.16. Cooler

|--|

Air to Air heat exchanger used to cool the raw gases down.

Includes Recirculation system of cooling air. This allows us to pre-heat the cooling air to help prevent acid corrosion on the cooling fins.

•	horizontal cooling fins
•	cleaning system for the cooling fins
•	includes cooling fans and damper
•	includes catwalk and ladder

4.3.15.17. Simplex System

5.	Quantity:	1 pc			

The FireTrace Indirect Dry Chemical Automatic Fire Extinguisher Unit is UL and ULC Listed by Underwriters Laboratories Inc. and approved by Factory Mutual Approvals (FM). These units are designed for total flooding and local applications, using ABC Dry Chemical Powder, in accordance with NFPA-17: Standard for Dry Chemical Extinguishing Systems. The FireTrace Dry Chemical Self-Contained Automatic Extinguisher Units have been tested to limits established by UL/ULC/FM in compliance with the requirements specified in UL 1254: Standard for Pre-Engineered Dry Chemical Extinguishing System Units and as detailed in this Manual.

Each installed unit is equipped with detection tubing, discharge piping, and nozzles. The pre-designed concept minimizes the amount of engineering involved in the application design. When the discharge piping and nozzles are installed within the limitations stated in this Manual, no hydraulic calculations are required to determine pressure drop, agent flow, or discharge time.

The hazard being protected can be any size, shape, or volume provided that the hazard being protected is within the limitations described in this Manual. When installed, each extinguisher unit is a self-contained unit, meaning that it is equipped with its own automatic (nonelectric) detection system. This system, when actuated, automatically releases the suppression agent into the hazard area.

Since the units are listed as automatic units (e.g. no simultaneous Manual or electric actuation means is provided), only one (1) extinguisher unit can be used to protect one hazard. These extinguisher units cannot be combined to protect a larger size hazard, since they are not designed to provide for simultaneous actuation of (2) or more units.

Local authorities having jurisdiction should be consulted as to the acceptability for particular hazards and requirements covering installation.

FireTrace Dry Chemical Automatic Indirect Units consists of the following major components:

- Cylinder/Valve assembly
- Cylinder Mounting Bracket
- FireTrace detection/actuation tubing and fittings (No substitute)
- Discharge nozzles
- Pressure switch (Optional)
- Discharge piping and fittings (Furnished by others)

Once installed, the FireTrace Automatic Unit becomes a self-contained, selfactuating unit that does not require an external source of power or electricity. The unit utilizes unique FireTrace flexible tubing that is attached to the top of the cylinder valve. This tubing is pressurized with dry nitrogen to maintain the cylinder valve in the closed position. This tubing acts as a continuous linear thermal detector that ruptures upon direct flame impingement or at high temperatures associated with fire conditions. Once the detection tubing is ruptured, the cylinder valve automatically opens, allowing the dry chemical to flow through the discharge piping, distributing the extinguishing agent through the nozzle(s) into the protected area. Upon actuation the optional pressure switch can be used to indicate discharge, shutdown ventilation, close all openings, shut-off electrical power, etc. as may be required.

Provisions must be made to provide means to close all openings in the hazard enclosure and shut-off ventilation at the time of discharge.

The total area of uncloseable openings shall not exceed 1 percent of the total area of the sides, top, and bottom of the enclosure.

APC Engineering 5.3.15.14.

Quantity: 1 set

for above listed items as follows

Mechanical Engineering

- · overall project management for the listed scope of supply
- preparation of drawings
- preparation of filter layout drawing and foundation load drawing
- preparation of layouts
- preparation of manufacturing drawings
- preparation of assembly drawings

Electrical Engineering

- preparation of flow diagram incl. P&ID list
- preparation of functional description and functional diagram
- · documentation for start-up/commissioning

The above includes the coordination with the customer and suppliers regarding the process engineering and the implementation planning.

5.3.15.15. APC Documentation

The following information will be provided

- Filter plant process description
- Operation manual
- Maintenance and lubrication instructions
- Spare parts list
- Wire diagrams
- · Terminal diagrams
- Documentation of PLC protocol (if PLC is part of the delivery)

Warning and information signs will be supplied in customer language.

5.3.15.16. **APC Labeling**

Quantity: 1 set

Signs/displays

- made from material, resistant to media and age
- washable
- adhesive or to be fixed with screws
- color: white background with black writing

5.4. ESTIMATED EMISSIONS

Combustion System Emissions 4.4.1.

Substance	Tons/year
СО	7.21
NOx	8.59
PM	0.16
PM ₁₀	0.65
PM _{2.5}	0.65
SO ₂	0.05
VOC	0.47
Formaldehyde	6.4E-0.3
Hexane	0.155
Pb	0.0004
Total HAP	0.16
CO ₂	10,306
CH ₄	0.20
N ₂ 0	0.19
CO ₂ e	10,369

The above listed emissions are taken from the Alcoa Request for Quotation. G&P does not believe the CO2 value is correct. We provide the below calculations for CO, NOx and CO2 calculated for furnace at high fire.

Expected Emissions:

CO = 0.022Lbs./mmBTU/Hr. @ 3% O2 or 15% excess air = 0.033Lbs./mmBTU/Hr. @1.5% O2 or 7% excess air

CO Calculated at 7% excess air:

0.033Lbs.CO/mmBTU/Hr. x 76mmBTU/Hr.(Total Input) x 24Hrs. x 365D = 21,970Lbs.

CO Tons per Year

21970Lbs. / 2000 = 10.985T x 0.65 (Overall Firing Rate WCS) = 7.14T/Yr.

NOx = 0.0603Lbs./mmBTU/Hr. NOx @3% O2 or 15% excess air = 0.0325Lbs./mmBTU/Hr. NOx(expected) @ 1.5% O2 or 7% excess air

NOx Calculated at 7% excess air:

0.0325Lbs NOx/mmBTU/Hr. x 76mmBTU (Total Input) x24Hrs. x 365D = 21,637Lbs.

NOx Tons per Year

21,637Lbs. / 2000 = 10.818T x 0.65 (Overall Firing Rate WCS) = 7.03T/Yr.

CO2 = 117Lbs CO2/mmBTU (constant) x 76mmBTU (Total Input) x 24Hrs. x 365D = 77,893,920Lbs.

CO2 Tons per Year

77.893.920 / 2000 = 38.947T/Yr. x.65 (Overall Firing Rate WCS) = 25.315T/Yr.

Alcoa restricted firing rates due to CO2 Spec. Levels = 10,306 / .65 (Overall Firing Rate WCS) = 15,855 x 2000Lbs = 31,710,769 / 117 CO2/mmBTU (constant) =21mm BTU/Hr. Max.

NOTE: Given and Constant CO, NOx, & CO2 numbers are taken from Bloom Combustion Systems Environmental Emissions Handbook and North American Mfg. high and medium velocity burner data files for sidewell and reservoir furnaces.

Stack Test Emissions 4.4.2.

<u>Substance</u>	Tons/year
Grains/dscf	0.005
CO	100
NOx	40
SO ₂	40
VOC	40
PM ,	25
PM ₁₀ (includes condensable emissions)	15
PM _{2.5} (includes condensable emissions)	10
Pb	0.6

4.5. ACCEPTANCE TESTING

See Commercial Proposal Section 5. Performance and Acceptance Testing

5. SCOPE OF WORK AND SUPPLY

The scope of the supply will consist of the engineering of the CSM System proper, refractory lining and the supply of the combustion system, controls, and all of the associated components and equipment needed to complete a new operational MCAM based on Gillespie & Powers, Inc.'s engineering documents.

The project shall be organized in the following phases:

5.1. ENGINEERING

- 5.1.1. Steel erection drawings
- 5.1.2. Steel detail and parts list drawings
- 5.1.3. Mechanical drawings and parts list (kiln)
- 5.1.4. Process flow and loss diagrams
- 5.1.5. Process interconnecting ductwork
- 5.1.6. Combustion air-gas & compressed air flow diagrams and parts list
- 5.1.7. Mechanical piping installation drawings
- 5.1.8. Combustion air piping drawing details and parts list
- 5.1.9. Electrical control ladder diagram
- 5.1.10. Electrical field power distribution diagrams and parts list
- 5.1.11. Foundation loading and Civil Design
- 5.1.12. Procurement of all materials and equipment
- 5.1.13. Supplementary supplied equipment engineering

5.2. FOUNDATION (by others)

5.3. PROCESS EQUIPMENT

- 5.3.1. Furnace
- 5.3.2. Eductors
- 5.3.3. Conveyance Systems
- 5.3.4. Charge Car(s)
- APC System 5.3.5.

5.4. STEEL WORK

- 5.4.1. Steel fabrication
 - 5.4.1.1. Furnace
 - 5.4.1.2. Platforms & access walkways
 - 5.4.1.3. Interconnecting ductwork
 - 5.4.1.4. Support framing
 - 5.4.1.5. Conveyor System
 - 5.4.1.6. APC System with Stack
- 5.4.2. Onsite steel structural installation.

5.5. REFRACTORY

- 5.5.1. Refractory material supply
- 5.5.2. Refractory material installation

5.6. COMBUSTION AIR PIPING

- 5.6.1. Combustion system procurement
- 5.6.2. Combustion air piping fabrication
- 5.6.3. Burner installation supervision
- 5.6.4. Combustion air piping and component installation

5.7. COMBUSTION GAS, COMPRESSED AIR AND IMPULSE PIPING

- 5.7.1. Prefabrication of fuel train
- 5.7.2. Supply all pipe, fittings, components and pipe supports/hangers
- 5.7.3. Installation of fuel train, main gas piping and pilot gas piping
- 5.7.4. Installation of compressed air for air valves (if used)
- 5.7.5. Installation of impulse piping

5.8. PROCESS DUCTWORK INSTALLATION

- 5.8.1. Supply all materials and equipment for the ductwork
- 5.8.2. Installation of ductwork refractory
- 5.8.3. Installation of main ductwork

5.9. ELECTRICAL

- 5.9.1. Supply control panel and all electrical field components
- 5.9.2. Installation of electrical control panel
- 5.9.3. Installation of all electrical field components such as: disconnects, limit switched, pushbuttons, thermocouples, flame detectors, etc.
- 5.9.4. Installation of conduit, conduit supports and conduit fittings, between the control panel, the MCC and the field components
- 5.9.5. Installation all wire and cable
- 5.9.6. Installation that marks and terminate all wire and cable (both ends)

5.10. PAINTING

- 5.10.1. Supply all paint and painting materials
- 5.10.2. Paint furnace according to the OSHA and ALCOA color codes (Prior to shipping), and any touch up on site.

5.11.START-UP

- 5.11.1. Power-up systems
- 5.11.2. Calibrate and set all field devices

- 5.11.3. Ring-out all wiring for termination accuracy
- 5.11.4. Check rotation of all motors
- 5.11.5. Test, modify and complete all PLC programming
- 5.11.6. Control Loop tuning

5.12. DRY OUT

- 5.12.1. Dry Out equipment and operators
- 5.12.2. Supervision of the Dry out according to approved schedule

5.13. TRAINING

5.13.1. Operator and maintenance personnel training

5.14. ENGINEERING DOCUMENTATION

- 5.14.1. Equipment operation and maintenance manual, catalog
- 5.14.2. Provide as constructed drawings

6. **MISCELLANEOUS ITEMS**

6.1. EQUIPMENT SERVICEABILITY

All the GP supplied equipment will be designed and installed with service and maintenance in mind. Standard and common parts will be used whenever possible. All lubrication points will be easily accessible for maintenance. Valves and electrical items will be placed where personnel can access them for service. If an item cannot be access with standard ladders, platform or walk ways will be installed. All serviceable piping items will have unions or flanges on either side of the items for ease of service.

6.2. SYSTEM SAFETY STANDARDS

GP takes safety very seriously. The equipment will be designed with proper labelling, guarding, and visual alarms.

All equipment process will have lock out, bleed, and test points for proper lock-out tag-out procedures.

6.3. MAINTENANCE MANUALS

Three (3) hard copy sets and three (3) digital operator and maintenance manual will be provided for all supplied equipment, to include service schedule and OEM parts lists.

6.4 START-UP COMMISSIONING

Gillespie and Powers, Inc. will perform the commission and check out of the combustion system along with tuning of the temperature controls loops to meet specifications, production, and energy efficiency demands. This will be for 7 / 8 hour days. The plant will need to supply material in an efficient manner to help facilitate the start-up and tuning.

6.5. OPERATIONS AND MAINTENANCE TRAINING

Our suggested operator and maintenance training prior to start-up and commissioning:

- 1-day classroom and 2 days on the floor training with the operators and maintenance crews. If training extends past the allotted time, normal billing rates will be applicable.
- The training will cover safety, operation, troubleshooting and planned maintenance.
- 1-day training with customer instrumentation personnel to introduce combustion system's automation documentation, structure and troubleshooting strategies.

Above training will include hard copies of excerpts from the documentation generated during the project (drawings, manuals etc...) as instructional material. These copies will be left with the attendees of the training.

We have allowed for 2 trainers for 21 days (including travel) for Start up and training

6.6. AS CONSTRUCTED DOCUMENTATION

All as constructed documentation will be completed within 45 days upon final commissioning and acceptance.

All drawings will be submitted digitally in AutoCAD 2000 or later format where applicable.

All documents will be in English

We reserve the right of not releasing proprietary details of construction

6.7. ONSITE PROJECT MANAGEMENT

GP will maintain an onsite Project Manager for the duration of the field constructions. through to commissioning of the furnaces and supplementary equipment.

In the event the primary project manager needs to leave the job site for an extended duration other than furlough and through no fault of the purchaser, GP will assign a temporary project manager to overlap with the primary project manager. The overlap will be for two days, allowing all project-based information to be properly conveyed between them. We have allowed for installation supervision for the duration of the project in our proposal.

6.8. SYSTEM INTEGRATIONS

GP will allow for 120 hours of onsite system integration between all 3rd party equipment not supplied by GP. Examples would include the additional operator HMI's, and data acquisition. Additional hours will be billed at current engineering rates posted.

6.9. AFTER COMMISSIONING SUPPORT

GP has free phone support on the supplied equipment for the duration of the service life. Scheduled onsite support is also available per current annual cycle engineering rates.

7. GENERAL EXEMPTIONS AND CLARIFICATIONS

7.1. SEE COMMERCIAL PROPOSAL BC-8175 R1

GP BID BC-8175

ALCOA WARRICK

CSM PROJECT

INDEPENDENT REVIEW & ANALYSIS OF G&P MCAM

APPENDIX 1

Gillespie & Powers engaged a third party, IES Engineers, to do a third party analysis and review of the Multi-Chamber Aluminum Melting Furnace (MCAM). Both furnace atmosphere (burners and gases) and aluminum melting were analyzed.

Contents:

- 1. Discussion of coated Scrap Melter Calculations
- 2. Coated Scrap Melter Summary
- 3. Heat Balance 0% VOC
- 4. Heat Balance 2% VOC
- 5. Heat Balance 4% VOC
- 6. Heat Balance 6% VOC

Gillespie and Powers, St. Louis, MO Discussion of Secondary Aluminum Coated Scrap Melter Calculations

1. Background

Gillespie and Powers (G&P) retained IES Engineers (IES) to assist in reviewing the heat balance and flow requirements for a coated scrap melter (CSM) for one of its clients. This page provides a brief description of the CSM designed by G&P, and the calculations completed by IES to support the G&P design effort.

2. General Description of the CSM

The proposed CSM is a two chamber gas fired unit designed to accept coated aluminum charge material. The intent of the design is to de-coat the aluminum in the first chamber by heating the material to the range of approximately 800 F on a dry hearth. The de-coating occurs as the organic material is volatilized. The atmosphere in the de-coating chamber is maintained with very little oxygen, consequently, any material volatilized will form an unburned volatile gas. This gaseous material will then pass out of the de-coating chamber into the heating chamber, along with the products of combustion from the burners in the de-coating chamber. An eductor is planned to assist the flow and help maintain appropriate static pressure in the de-coating chamber.

After de-coating, the aluminum material is then pushed into a recirculating molten aluminum bath by the next charge. The bath melts the now de-coated aluminum, and which flows into the second heating chamber where it is reheated for recirculation and prepared for casting.

Air will be added to the heating chamber to provide destruction of the volatiles from the de-coating chamber through oxidation. The heat from the combustion of the volatiles will reduce the gas firing required in the heating chamber, providing heat to the aluminum bath. The aluminum bath is recirculated from the heating chamber to the melting bath in the de-coater chamber using a molten aluminum pump.

3. Calculations Performed

IES calculated the heat requirements for drying the aluminum, de-coating the aluminum, melting the aluminum, and bringing the aluminum to the hot melt temperature of 1,435 F. Refractory losses were provide by G&P. Total gas fire was calculated based on the process material heating requirements, refractory heat losses, and heat required to heat combustion air to the operating temperature. Combustion air required for volatiles was also calculated based on the estimated heat value of the volatiles. Calculations were performed for an aluminum feed of 33,000 lb/hr with volatile content ranging from 0% to 6%. At volatile contents higher than 6%, the heat release from the volatiles exceeds the amount of heat required to operate the furnace, and could lead to an overheat condition unless other cooling methods are utilized. For calculation assumptions and results, please see the assumption sheet and results diagrams.

Gillespie and Powers, St. Louis, MO Discussion of Secondary Aluminum Coated Scrap Melter Calculations

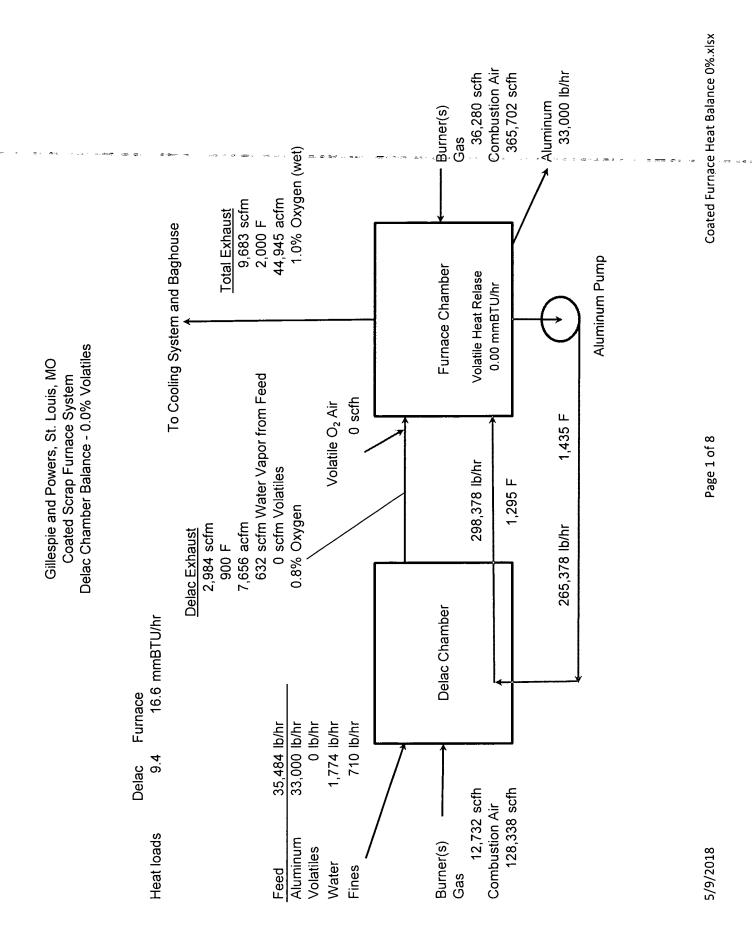
4. Calculation Limitations

There are a number of limitations to the calculations performed. These include the following:

- a. The method used assumed a more or less continuous feed rate, and more or less continuous volatilization of the organics. However, the de-coater is planned to be batch fed, and there may be times during the cycle where volatilization is more rapid than average, requiring additional combustion air in the heating chamber when volatiles are oxidized. This will result in higher instantaneous heat release from volatiles also.
- b. IES did not include an allowance for leakage around shut doors. As long as the de-coating chamber is maintained zero to slightly positive, this leakage should be negligible.
- c. IES did not have accurate heat transfer coefficients between the hot air in the de-coating chamber, and the aluminum scrap. These coefficients will vary with air flow velocity, shape and density of the scrap, and other factors. Therefore actual penetration of the heat into the load may vary from calculated values.
- d. Similarly, IES did not have accurate heat transfer coefficients between the molten aluminum and the solid aluminum in the recirculating bath, so melt times and bath temperatures could be more variable that indicated. Bath temperature differential was adjusted to achieve a ratio of 8 between pumped aluminum and melted aluminum.
- e. Calculated burner flow rates are based on average feed rates, and will vary depending on a number of variables. Startup and change of setpoint conditions will also be different, and will be based on final burner design capability.
- f. Similarly the exhaust flow rate given is based on average conditions, and may vary depending on feed rate, moisture content, and volatile content, as well as burner firing rates.

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Calculation Summary

Volatile Content		0%	2%	4%	6%
Feed				_	
Aluminum	lb/hr	33,000	33,000	33,000	33,000
Volatiles	lb/hr	0	725	1,483	2,276
Moisture	lb/hr	1,774	1,813	1,854	1,897
Fines	lb/hr	710	725	742	759
Total feed	lb/hr	35,484	36,264	37,079	37,931
De-coating Chamber					
Burner gas	scfh	12,732	13,402	14,102	14,834
Burner combustion air	scfh	128,338	135,089	142,144	149,523
Exhaust flow	scfm	2,984	3,160	3,344	3,537
Exhaust temperature	F	900	900	900	900
Aluminum flow into bath	lb/hr	265,378	265,378	265,378	265,378
Heating Chamber					
Burner gas	scfh	36,280	24,746	12,693	86
Burner combustion air	scfh	365,702	249,437	127,947	871
Volatile heat release	mmBTU/hr	0.0	10.2	20.8	31.9
Air for volatile combustion	scfh	0	109,181	223,269	342,603
Exhaust flow	scfm	9,683	9,632	9,578	9,521
Exhaust temperature	F	2,000	2,000	2,000	2,000
Exhaust oxygen content	wet	1.0%	1.0%	1.1%	1.1%
Exhaust moisture content	wet	23.4%	21.9%	20.4%	18.8%
Total Gas Consumption	scfh	49,012	38,147	26,795	14,920
Total Gas Heat (at 1,020 BTU/scf)	mmBTU/hr	50.0	38.9	27.3	15.2
Gas heat per lb aluminum	BTU/lb	1,515	1,179	828	461
Total heat with volatiles	mmBTU/hr	50.0	49.1	48.1	47.1
Total heat per lb aluminum	BTU/lb	1,515	1,487	1,457	1,427



Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System **Calculation Assumptions**

Feed assumptions		
Average feed rate desired		35,484 lb/hr
Based on breakdown below, aluminum melted will be		33,000 lb/hr
Feed Content		Wt %
Aluminum		93.0%
Volatiles		0.0%
Moisture		5.0%
Fines		2.0%
Aluminum heat properties		
Melt point	657 C	1,215 F
Heat of fusion		169.0 BTU/lb
Solid specific heat		
Average 60 F to melt point		0.248 BTU/lb F
Average 61 to 579		0.225 BTU/lb F
Liquid specific heat		0.260 BTU/lb F
	sg	_
Solid density	2.671	166.7 lb/ft ³
Liquid density	2.375	148.2 lb/ft ³
Heat content of fuels		
Heat content of volatiles	7,778 kcal/kg	14,000 BTU/lb
Natural gas heat content (lower heat value)	8,236 kcal/sm ³	925 BTU/scf
Natural gas gravity vs air		0.60
Natural gas higher heat value (reference only)		1,020 BTU/scf
Operating temperatures		
Melt furnace air temperature	1;093 C	2,000 F
Melt furnace aluminum temperature	779 C	1,435 F
Delac furnace air temperature	482 C	900 F
Delac furnace metal temperature	427 C	800 F
Baghouse inlet temperature	204 C	400 F
Average indoor/aluminum temperature	21 C	70 F
Assumed metal entering temperature = indoor	21 C	70 F
Heat losses from refractory		
Heat loss from delac refractory	192,527 kcal/hr	764,000 BTU/hr
Heat loss from melt furnace refractory	282,238 kcal/hr	1,120,000 BTU/hr

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Calculation Assumptions

Thermal properties of volatiles

Specific heat of liquid	1 15 2 2 2	· · - · - · · · · · · · · · · · · ·	0.56 kcal/kg C	0.56 BTU/lb F
Heat of vaporization			61.1 kcal/kg	110.0 BTU/lb
Specific heat of gases			0.60 kcal/kg	0.60 BTU/lb F
Assumed boiling point			93 C	200 F

BTU/scf air for volatile combustion at 2% to 3% ${\rm O_2}$ in exhaust

93 BTU/scf air

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Delac Chamber Balance - 0.0% Volatiles

Average throughput of f	eed	35,484 lb/hr
Breakdown		
Aluminum	93.0%	33,000 lb/hr
Volatiles	0.0%	0 lb/hr
Moisture	5.0%	1,774 lb/hr
Fines	2.0%	710 lb/hr

Heat to components of feed in the chamber (not including melting in aluminum bath						
Stage 1: Feed Heating and Delac Aluminum Heat Start temperature Final temperature dT Specific heat Heat required (at 33,000 lb/hr)			70 F 800 F 730 F 0.248 BTU/lb 5,974,320 BTU/hr	F		
Volatiles (no combustion at this time) Heat Start temperature Vaporization temperature Final temperature			70 F 200 F 900 F			
	Specific heat BTU/ lb F	dT F	BTU/lb			
Heat to vaporization	0.56	130	72.8			
Latent heat			110.0			
Heat from vaporization to final	0.60	700_	420.0			
Total unit heat			602.8			
Heat required (at 0 lb/hr)			0 BTU/hr			
Majatura Hart						
Moisture Heat Start temperature			70 F			
Vaporization temperature			212 F			
Final temperature			900 F			
i mai temperatare			000 1			
	Specific heat BTU/	.T.E	DTI III			
	lb F	dT F	BTU/lb			
Heat to vaporization Latent heat	1.00	142	142.0 970.3			
Heat from vaporization to final	0.477	688	970.3 328.1			
Total unit heat	0.477	000_	1,440.4			
Heat required (at 1,774 lb/hr)			2,555,549 BTU/hr			
ricat required (at 1,774 io/iii)			2,000,048 010/11			

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Delac Chamber Balance - 0.0% Volatiles

Fines Heat				
Start temperature			70	F
Final temperature (assumed to leave with	gases)		900	F:
dT	,		830	F
Specific heat			0.248	BTU/lb F
Heat required (at 710 lb/hr)			146,080	BTU/hr
Summary of feed heat loads				
Aluminum			5,974,320	BTU/hr
Volatiles			0	
Moisture			2,555,549	
Fines		_	146,080	
Total heat requirement for materials			8,675,949	BTU/hr
Add hoot losses through refractory			764,000	DTI I/br
Add heat losses through refractory Total heat requirement, not including meltir	ng.	-	9,439,949	
Total heat requirement, not including metti	ıg		9,439,549	БТО/ПІ
First pass, assume this is provided by natu	ral gas firing			
Stoichiometric A/F ratio	iai gao iii ii g		9.6	to 1
Assume excess air in burner			5%	
As fired air to fuel				scf air/scf gas
Heat required to heat 1 scf of gas to delac	gas temperatur	e		BTU/scf gas
Heat required to heat air to delac gas temp				BTU/scf gas
Heat from gas fire (LHV)	0.0.0			BTU/scf gas
Net heat from gas firing to delac gas temper	erature			BTU/scf gas
The mount from guo mang to uplue guo tempe	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			2 1 3/331 gas
Gas flow required			12,732 9	scfh
Combustion air required			128,338	scfh
Stage 2: Aluminum melting in bath				
Aluminum to be melted			33,000	h/hr
Metal temperature at start			800 1	
Melt point			1,215 !	
Final flowing temperature			1,215 1	
Final flowing temperature	Specific		1,290 1	
	heat BTU/			
	lb F	dT F	BTU/lb	
Heat to melt point	0.248	415	102.9	
Heat of fusion	3.2.10	,,,	169.0	
Heat of liquid to temp	0.260	80	20.8	
Total unit heat requirement	5.200		292.7	
rotal and noat rogaliomont			202.1	
Heat required from aluminum bath			9,659,760 8	3TU/hr

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Delac Chamber Balance - 0.0% Volatiles

Aluminum hot bath temperature		1,435 F				
Mixed temperature		1,295 F				
dT				140 F		
Specific heat of liquid				0.260 B		
Unit heat of molten aluminum				36.40 B	TU/lb	
Molten aluminum flow required				265,378 lb	/hr	
Ratio of recirculated aluminum	to melted alui	minum		8.0 to	1	
Assumed density of aluminum	liquid			148.2 lb	/ft ³	
Volume flow is then				29.84 ft ³	³/min	
				223.3 ga	al/min	
Exhaust flow from chamber						
Burner flow				2,351.2 so	rfm	
Moisture from feed		1,774 lt	n/hr	632.5 sc		
Volatiles		· ·	o/hr	0.0 sc		
	volotilos	120	7/111	0.0 Sciiii		
assumed molecular weight of		120		2 092 6 66	ofm	
Total volumetric flow in gas stre	eam	000 5	-	2,983.6 scfm		
Flow at delac temperature		900 F		7,656 ad	om)	
Review gas breakdown	MW	lb/hr	by wt	scfm	by vol	
Nitrogen	28	7,373.6	61.9%	1,689.8	56.6%	
Oxygen	32	123.6	1.0%	24.8	0.8%	
Carbon dioxide	44	1,455.1	12.2%	212.2	7.1%	
Water vapor	18	2,964.7	24.9%	1,056.9	35.4%	
Volatiles	120	0.0	0.0%	0.0	0.0%	
Total	_	11,917.0	100.0%	2,983.6	100.0%	

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Furnace Melt Chamber Balance - 0.0% Volatiles

Incoming materials Temperature of gas stream			900	F
Gas stream	lb/hr	scfm		
Nitrogen	7,374	1,690		
Oxygen	124	25		
Carbon dioxide	1,455	212		
Water vapor	2,965	1,057		
Volatiles	0	0		
Total	11,917	2,984		
Target chamber temperature			2,000	F
Heat to heat gases to chamber temperat	ure		,	
Nitrogen			2,281,598	
Oxygen			35,515	
Carbon dioxide			474,793	
Water vapor			1,818,011	
•	Sp Heat			
	BTU/lb F	dT F		
Volatiles	0.60	1,100_	0	•
Total			4,609,918	
Aluminum (molten)				
Temperature			1,295	F
Target bath temperature			1,435	F
dT	lb/hr		140	F
From newly melted material	33,000			
Recirculated material	265,378			
Total molten aluminum flow rate	298,378			
Specific heat for molten aluminum			0.26	BTU/lb F
Heat required to heat aluminum is then			10,860,960	BTU/hr
Summary of heat required				
Incoming gases from delac chamber			4,609,918	BTU/hr
Aluminum	•		10,860,960	BTU/hr
Refractory heat losses			1,120,000	
Total heat load in melt furnace		_	16,590,878	BTU/hr
Less heat from volatiles			Λ	lb/hr
x heat value of volatiles				BTU/lb
Heat from volatiles				BTU/hr
Heat release per scf of combustion air for	r volatiles			BTU/scf
Air required for volatile combustion	-			scfh
- 				lb/hr
Unit heat required to heat this air to cham	nber temperature		511.86	

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Furnace Melt Chamber Balance - 0.0% Volatiles

Heat required to heat this air to chamber temperature

0 BTU/hr

Heat from volatiles net of combustion air heat requirements

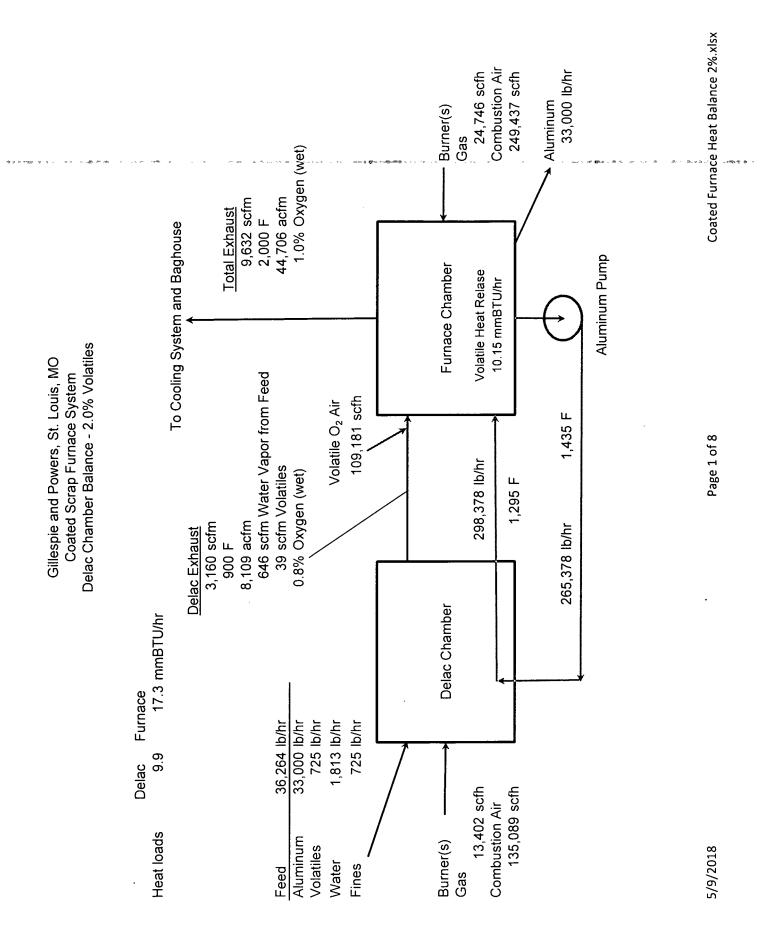
0 BTU/hr

16,590,878 BTU/hr
9.6 to 1
5%
10.08 scf air/scf gas
-80.74 BTU/scf gas
-386.96 BTU/scf gas
925 BTU/scf gas
457.30 BTU/scf gas
36,280 scfh
365,702 scfh

		From			
	From Delaq	Volatile	From Gas	Total Flow	
Flow from system	scfm	Comb. scfm	Comb. scfm	scfm	% by volume
Nitrogen	1,690	0	4,815	6,505	67.2%
Oxygen	25	0	71	95	1.0%
Carbon dioxide	212	0	605	817	8.4%
Water vapor	1,057	0	1,209	2,266	23.4%
Total	2,984	0	6,700	9,683	100.0%

Total flow at 2,000 F

44,945 acfm



Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Calculation Assumptions

Feed assumptions			
Average feed rate desired		36,264	lb/hr
Based on breakdown below, aluminum melted will	be	33,000	lb/hr
Feed Content		Wt %	
Aluminum		91.0%	
Volatiles		2.0%	
Moisture		5.0%	
Fines		2.0%	
Aluminum heat properties			•
Melt point	657 C	1,215	F
Heat of fusion		169.0	BTU/lb
Solid specific heat			
Average 60 F to melt point			BTU/lb F
Average 61 to 579			BTU/lb F
Liquid specific heat		0.260	BTU/lb F
	sg		_
Solid density	2.671	166.7	lb/ft ³
Liquid density	2.375	148.2	lb/ft ³
Heat content of fuels			
Heat content of volatiles	7,778 kcal/kg	14,000	BTU/lb
Natural gas heat content (lower heat value)	8,236 kcal/sm ³	925	BTU/scf
Natural gas gravity vs air		0.60	
Natural gas higher heat value (reference only)		1,020	BTU/scf
Operating temperatures			
Melt furnace air temperature	1,093 C	2,000	F
Melt furnace aluminum temperature	779 C	1,435	
Delac furnace air temperature	482 C	900	
Delac furnace metal temperature	427 C	800	F
Baghouse inlet temperature	204 C	400	F
Average indoor/aluminum temperature	21 C	70	F
Assumed metal entering temperature = indoor	21 C	70	F
Heat losses from refractory			
Heat loss from delac refractory	192,527 kcal/hr	764,000	
Heat loss from melt furnace refractory	282,238 kcal/hr	1,120,000	BTU/hr

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Calculation Assumptions

Thermal properties of volatiles

Approximate volatile thermal properties with that of oil		
Specific heat of liquid	0.56 kcal/kg C	0.56 BTU/lb F
Heat of vaporization	61.1 kcal/kg	110.0 BTU/lb
Specific heat of gases	0.60 kcal/kg	0.60 BTU/lb F
Assumed boiling point	93 C	200 F

BTU/scf air for volatile combustion at 2% to 3% ${\rm O_2}$ in exhaust

93 BTU/scf air

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Delac Chamber Balance - 2.0% Volatiles

Average throughput of fo	eed	36,264 lb/hr
Breakdown		
Aluminum	91.0%	33,000 lb/hr
Volatiles	2.0%	725 lb/hr
Moisture	5.0%	1,813 lb/hr
Fines	2.0%	725 lb/hr

Heat to components of feed in the chamber (not including melting in aluminum bath

Theat to componente of food in the chamber (not including metting in diaminant bath					
Stage 1: Feed Heating and Delac					
Aluminum Heat					
Start temperature			70 F		
Final temperature			800 F		
dT			730 F		
Specific heat			0.248 BTU/lb F		
Heat required (at 33,000 lb/hr)			5,974,320 BTU/hr		
			,		
Volatiles (no combustion at this time) Heat					
Start temperature			70 F		
Vaporization temperature			200 F		
Final temperature			. 900 F		
	Specific				
	heat BTU/				
	lb F	dT F	BTU/lb		
Heat to vaporization	0.56	130	72.8		
Latent heat			110.0		
Heat from vaporization to final	0.60	700	420.0		
Total unit heat		_	602.8		
Heat required (at 725 lb/hr)			437,196 BTU/hr		
Moisture Heat					
Start temperature			70 F		
Vaporization temperature			212 F		
Final temperature			900 F		
	Specific				
	heat BTU/				
	lb F	dT F	BTU/lb		
Heat to vaporization	1.00	142	142.0		
Latent heat			970.3		
Heat from vaporization to final	0.477	688	328.1		
Total unit heat	2		1,440.4		
Heat required (at 1,813 lb/hr)			2,611,715 BTU/hr		
			, ,		

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Delac Chamber Balance - 2.0% Volatiles

Fines Heat				
Start temperature			70	F
Final temperature (assumed to leave with	gases)	e menoral anno esta	900	F ====================================
dT	-		830	F
Specific heat			0.248	BTU/lb F
Heat required (at 725 lb/hr)			149,291	BTU/hr
Summary of feed heat loads				
Aluminum			5,974,320	BTU/hr
Volatiles			437,196	
Moisture			2,611,715	
Fines			149,291	
Total heat requirement for materials			9,172,521	BTU/hr
Add heat losses through refractory			764,000	BTU/hr
Total heat requirement, not including meltir	ng	_	9,936,521	BTU/hr
First page assume this is provided by patu	ral and firing			
First pass, assume this is provided by natu Stoichiometric A/F ratio	rai yas ililiiy		9.6	to 1
Assume excess air in burner			5.0 5%	10 1
As fired air to fuel				scf air/scf gas
Heat required to heat 1 scf of gas to delac	aas temneratur	a		BTU/scf gas
Heat required to heat it so of gas to delac	-	5		BTU/scf gas
· · · · · · · · · · · · · · · · · · ·	erature			BTU/scf gas
Heat from gas fire (LHV) Net heat from gas firing to delac gas temperature				BTU/scf gas
Net fleat from gas filling to delac gas temper	- ·		771.77	D 1 0/3Cl gas
Gas flow required			13,402	scfh
Combustion air required			135,089	scfh
O. O. Al. orionne malting in heat				
Stage 2: Aluminum melting in bath				
Aluminum to be melted			33,000	lb/hr
Metal temperature at start	·		800	F
Melt point			1,215	F
Final flowing temperature			1,295	F
·	Specific			
	heat BTU/			
	lb F	dT F	BTU/lb	
Heat to melt point	0.248	415	102.9	
Heat of fusion			169.0	
Heat of liquid to temp	0.260	80_	20.8	
Total unit heat requirement		_	292.7	
Heat required from aluminum bath			9,659,760	BTU/hr

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Delac Chamber Balance - 2.0% Volatiles

Aluminum hot bath temperatur	re				1,435 F	:
Mixed temperature					1,295 F	:
dT					140 F	-
Specific heat of liquid					0.260 E	BTU/lb F
Unit heat of molten aluminum					36.40 E	BTU/lb
Molten aluminum flow required					265,378 lk	o/hr
Ratio of recirculated aluminum to melted aluminum					8.0 to	o 1
Assumed density of aluminum	liquid				148.2 lk	o/ft ³
Volume flow is then					29.84 ft	³ /min
					223.3 g	
Exhaust flow from chamber						
Burner flow					2,474.9 s	cfm
Moisture from feed			1,813	h/hr	646.4 s	
Volatiles			725 II		38.8 s	= '
assumed molecular weight o	f volatiles		120	57111	30.0 3	Citi
Total volumetric flow in gas str			120		3,160.0 s	cfm
Flow at delac temperature	ou		900 F	:	8,109 a	
Tion at acido temperatare					0,100 a	····
Review gas breakdown	MW		lb/hr	by wt	scfm	by vol
Nitrogen		28	7,761.5	58.7%	1,778.7	56.3%
Oxygen	1	32	130.1	1.0%	26.1	0.8%
Carbon dioxide	*	44	1,531.6	11.6%	223.4	7.1%
Water vapor		18	3,066.3	23.2%	1,093.1	34.6%
Volatiles	1	120_	725.3	5.5%	_ 38.8	1.2%
Total			13,214.8	100.0%	3,160.0	100.0%

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Furnace Melt Chamber Balance - 2.0% Volatiles

Incoming materials Temperature of gas stream			900 F	=
Gas stream	lb/hr	scfm	300 1	
Nitrogen	7,761	1,779	2mm 3 v v8 //	
Oxygen	130	26		
Carbon dioxide	1,532	223		
Water vapor	3,066	1,093		
Volatiles	725	39		
Total	13,215	3,160		
Tarant ab amb antonin antoni			2 000 5	_
Target chamber temperature	uro		2,000 F	-
Heat to heat gases to chamber temperat	ure		2 401 619	
Nitrogen			2,401,618	
Oxygen Carbon dioxide			37,383	
			499,769	
Water vapor	Sp Heat		1,880,325	
	BTU/lb F	dT F		
Volatiles	0.60	1,100	478,681	
Total	0.00	1,100_	5,297,777	
lotai			3,237,777	
Aluminum (molten)				
Temperature			1,295 F	-
Target bath temperature			1,435 F	
dT	lb/hr		140 F	
From newly melted material	33,000			
Recirculated material	265,378			
Total molten aluminum flow rate	298,378		•	
Specific heat for molten aluminum	ŕ		0.26 E	BTU/lb F
•				
Heat required to heat aluminum is then			10,860,960 E	BTU/hr
Summary of heat required				
Incoming gases from delac chamber			5,297,777 E	
Aluminum			10,860,960 E	
Refractory heat losses		_	1,120,000 E	
Total heat load in melt furnace			17,278,737 B	BTU/hr
Less heat from volatiles			725 lk	o/hr
x heat value of volatiles			14,000 B	
Heat from volatiles			10,153,846 B	
Heat release per scf of combustion air for	r volatiles			BTU/scf
Air required for volatile combustion	-		109,181 s	
			8,189 lb	
Unit heat required to heat this air to cham	nber temperature		511.86 B	
•	•			

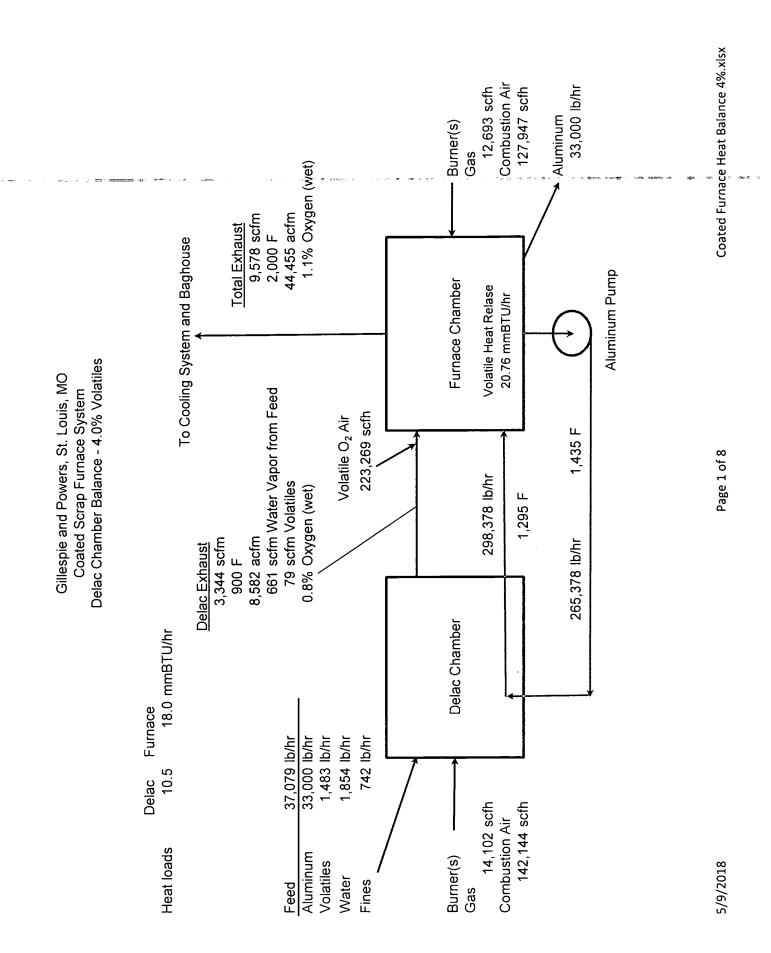
Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Furnace Melt Chamber Balance - 2.0% Volatiles

Heat required to heat this air to chamber temperature	4,191,372 BTU/hr
Heat from volatiles net of combustion air heat requirements	5,962,474 BTU/hr
Balance of heat from the burner system	11,316,263 BTU/hr
Review natural gas firing	
Stoichiometric A/F ratio	9.6 to 1
Assume excess air in burner	5%
As fired air to fuel	10.08 scf air/scf gas
Heat required to heat 1 scf of gas to delac gas temperature	-80.74 BTU/scf gas
Heat required to heat air to delac gas temperature	-386.96 BTU/scf gas
Heat from gas fire (LHV)	925 BTU/scf gas
Net heat from gas firing to delac gas temperature	457.30 BTU/scf gas
Gas fire required	24,746 scfh
Combustion air required	249,437 scfh

		From			
	From Delaq	Volatile	From Gas	Total Flow	
Flow from system	scfm	Comb. scfm	Comb. scfm	scfm	% by volume
Nitrogen	1,779	1,438	3,284	6,500	67.5%
Oxygen	26	25	48	100	1.0%
Carbon dioxide	223	283	412	919	9.5%
Water vapor	1,093	195	825	2,113	21.9%
Total	3,121	1,941	4,570	9,632	100.0%

Total flow at 2,000 F

44,706 acfm



Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Calculation Assumptions

Feed assumptions Average feed rate desired Based on breakdown below, aluminum melted will be Feed Content Aluminum Volatiles Moisture Fines	e	37,079 lb/hr 33,000 lb/hr Wt % 89.0% 4.0% 5.0% 2.0%
Aluminum heat properties		
Melt point	657 C	1,215 F
Heat of fusion		169.0 BTU/lb
Solid specific heat		
Average 60 F to melt point		0.248 BTU/lb F
Average 61 to 579		0.225 BTU/lb F
Liquid specific heat		0.260 BTU/lb F
	sg	3
Solid density	2.671	166.7 lb/ft ³
Liquid density	2.375	148.2 lb/ft ³
Heat content of fuels		
Heat content of volatiles	7,778 kcal/kg	14,000 BTU/lb
Natural gas heat content (lower heat value)	8,236 kcal/sm ³	925 BTU/scf
Natural gas gravity vs air	-,	0.60
Natural gas higher heat value (reference only)		1,020 BTU/scf
Operating temperatures		
Melt furnace air temperature	1,093 C	2,000 F
Melt furnace aluminum temperature	779 C	1,435 F
Delac furnace air temperature	482 C	900 F
Delac furnace metal temperature	427 C	800 F
Baghouse inlet temperature	204 C	400 F
Average indoor/aluminum temperature	21 C	70 F
Assumed metal entering temperature = indoor	21 C	70 F
Heat losses from refractory		
Heat loss from delac refractory	192,527 kcal/hr	764,000 BTU/hr
Heat loss from melt furnace refractory	282,238 kcal/hr	1,120,000 BTU/hr

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Calculation Assumptions

Thermal properties of volatiles

Approximate volatile thermal propertie	es with	that	of oil
--	---------	------	--------

 Specific heat of liquid 	0.56 kcal/kg C	0.56 BTU/lb F
Heat of vaporization	61.1 kcal/kg	110.0 BTU/lb
Specific heat of gases	0.60 kcal/kg	0.60 BTU/lb F
Assumed boiling point	93 C	200 F

BTU/scf air for volatile combustion at 2% to 3% ${\rm O_2}$ in exhaust

93 BTU/scf air

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Delac Chamber Balance - 4.0% Volatiles

Average throughput of for	eed	37,079 lb/hr
Breakdown		
Aluminum	89.0%	33,000 lb/hr
Volatiles	4.0%	1,483 lb/hr
Moisture	5.0%	1,854 lb/hr
Fines	2.0%	742 lb/hr

Heat to components of feed in the chamber (not including melting in aluminum bath

Heat to components of feed in the chamber (not including melting in aluminum bath					
Stage 1: Feed Heating and Delac Aluminum Heat					
Start temperature			70 F		
Final temperature			800 F		
dT			730 F		
Specific heat			0.248 BTU/lb F		
Heat required (at 33,000 lb/hr)			5,974,320 BTU/hr		
Volatiles (no combustion at this time) Heat					
Start temperature			70 F		
Vaporization temperature			200 F		
Final temperature			900 F		
	Specific				
	heat BTU/				
	lb F	dT F	BTU/lb		
Heat to vaporization	0.56	130	72.8		
Latent heat			110.0		
Heat from vaporization to final	0.60	700	420.0		
Total unit heat		-	602.8		
Heat required (at 1,483 lb/hr)			894,040 BTU/hr		
Moisture Heat					
Start temperature			70 F		
Vaporization temperature			212 F		
Final temperature			900 F		
	Specific				
	heat BTU/				
	lb F	dT F	BTU/lb		
Heat to vaporization	1.00	142	142.0		
Latent heat			970.3		
Heat from vaporization to final	0.477	688_	328.1		
Total unit heat		_	1,440.4		
Heat required (at 1,854 lb/hr)			2,670,405 BTU/hr		

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Delac Chamber Balance - 4.0% Volatiles

Fines Heat				
Start temperature			70	F
Final temperature (assumed to leave with	gases)	.co inque	900	F*************************************
dT	,		830	F
Specific heat			0.248	BTU/lb F
Heat required (at 742 lb/hr)			152,645	BTU/hr
Summary of feed heat loads				
Aluminum			5,974,320	BTU/hr
Volatiles			894,040	210,111
Moisture			2,670,405	
Fines			152,645	
Total heat requirement for materials		_	9,691,411	BTU/hr
			704.000	DT1.1/
Add heat losses through refractory		_	764,000	
Total heat requirement, not including melting	ng ·		10,455,411	B1U/hr
First pass, assume this is provided by natu	ral gas firing			
Stoichiometric A/F ratio			9.6	to 1
Assume excess air in burner			5%	
As fired air to fuel			10.08	scf air/scf gas
Heat required to heat 1 scf of gas to delac gas temperature				BTU/scf gas
Heat required to heat air to delac gas temperature				BTU/scf gas
Heat from gas fire (LHV)				BTU/scf gas
Net heat from gas firing to delac gas temper	erature			BTU/scf gas
Gas flow required			14,102	scfh
Combustion air required			142,144	
Combustion all required			172,177	30111
Stage 2: Aluminum melting in bath				
Aluminum to be melted			33,000	lb/hr
Metal temperature at start			800	F
Melt point			1,215	F
Final flowing temperature			1,295	F
· ·	Specific		·	
	heat BTU/		57.14	
	lb F	dT F	BTU/lb	
Heat to melt point	0.248	415	102.9	
Heat of fusion			169.0	
Heat of liquid to temp	0.260	80_	20.8	
Total unit heat requirement			292.7	
Heat required from aluminum bath			9,659,760	BTU/hr

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Delac Chamber Balance - 4.0% Volatiles

Aluminum hot bath temperatur	е			1,435 F	
Mixed temperature				1,295 F	
dT				140 F	
Specific heat of liquid				0.260 B	TU/lb F
Unit heat of molten aluminum				36.40 B	TU/lb
Molten aluminum flow required				265,378 lb.	/hr
Ratio of recirculated aluminum	to melted alur	minum		8.0 to	1
Assumed density of aluminum	liquid			148.2 lb	/ft ³
Volume flow is then				29.84 ft ³	³ /min
				223.3 ga	al/min
Exhaust flow from chamber					
Burner flow				2,604.1 sc	:fm
Moisture from feed		1,854 lk	o/hr	660.9 sc	
Volatiles		1,483 lk		79.3 sc	
assumed molecular weight of	volatiles	120		, , , ,	
Total volumetric flow in gas stre			_	3,344.3 sc	:fm
Flow at delac temperature		900 F	:	8,582 ac	
Do to our breatstoon	B 41 A 7	11- /1	1 4		L
Review gas breakdown	MW	lb/hr	by wt	scfm	by vol
Nitrogen	28	8,166.8	56.0%	1,871.6	56.0%
Oxygen	32	136.9	0.9%	27.5	0.8%
Carbon dioxide	44	1,611.6	11.1%	235.0	7.0%
Water vapor	18	3,172.5	21.8%	1,130.9	33.8%
Volatiles	120_	1,483.1	10.2%	79.3	2.4%
Total		14,571.0	100.0%	3,344.3	100.0%

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Furnace Melt Chamber Balance - 4.0% Volatiles

Incoming materials Temperature of gas stream			900	F
Gas stream	lb/hr	scfm		•
Nitrogen	8,167	1,872		
Oxygen	137	27		
Carbon dioxide	1,612	235		
Water vapor	3,173	1,131		
Volatiles	1,483	79		
Total	14,571	3,344		
Target chamber temperature			2,000	F
Heat to heat gases to chamber temperatu	ıre			
Nitrogen			2,527,031	
Oxygen			39,336	
Carbon dioxide			525,867	
Water vapor			1,945,440	•
	Sp Heat			
	BTU/lb F	dT F		
Volatiles	0.60	1,100_	978,876	
Total			6,016,551	
Aluminum (molten)				
Temperature			1,295	F
Target bath temperature			1,435	F .
dT	lb/hr		140	F
From newly melted material	33,000			
Recirculated material	265,378			
Total molten aluminum flow rate	298,378			
Specific heat for molten aluminum			0.26	BTU/lb F
Heat required to heat aluminum is then			10,860,960	BTU/hr
Summary of heat required				
Incoming gases from delac chamber			6,016,551	RTI I/hr
Aluminum			10,860,960	
Refractory heat losses			1,120,000	
Total heat load in melt furnace		-	17,997,511	
Total float load in melt famado			11,001,011	<i>5</i> , <i>6</i> ,
Less heat from volatiles			1,483	lb/hr
x heat value of volatiles			14,000	BTU/lb
Heat from volatiles			20,764,045	
Heat release per scf of combustion air for	volatiles		93	BTU/scf
Air required for volatile combustion			223,269	scfh
			16,745	
Unit heat required to heat this air to cham	ber temperature		511.86	BTU/lb

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Furnace Melt Chamber Balance - 4.0% Volatiles

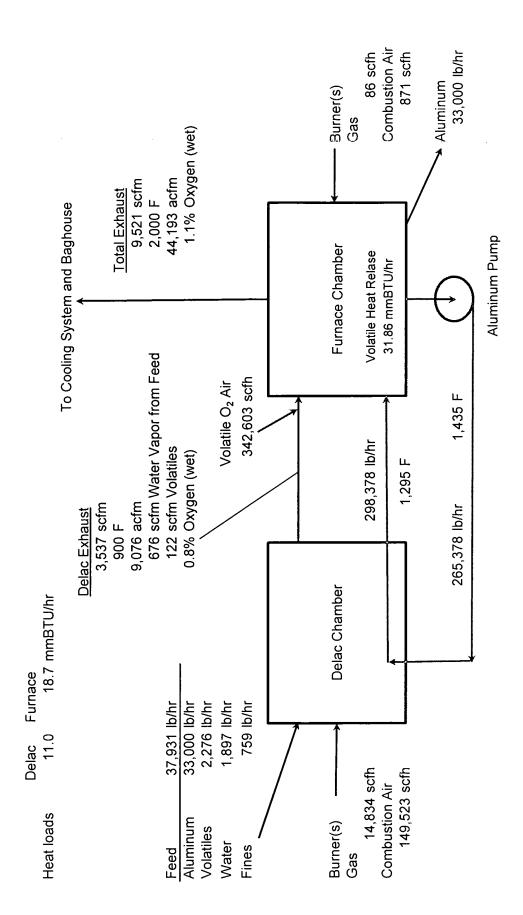
Heat required to heat this air to chamber temperature	8,571,120 BTU/hr
Heat from volatiles net of combustion air heat requirements	12,192,925 BTU/hr
Balance of heat from the burner system	5,804,586 BTU/hr
Review natural gas firing Stoichiometric A/F ratio Assume excess air in burner As fired air to fuel Heat required to heat 1 scf of gas to delac gas temperature Heat required to heat air to delac gas temperature Heat from gas fire (LHV) Net heat from gas firing to delac gas temperature	9.6 to 1 5% 10.08 scf air/scf gas -80.74 BTU/scf gas -386.96 BTU/scf gas 925 BTU/scf gas 457.30 BTU/scf gas
Gas fire required	12,693 scfh

	- D.	From	- 0	T	
	From Delaq	Volatile	From Gas	Total Flow	
Flow from system	scfm	Comb. scfm	Comb. scfm	scfm	% by volume
Nitrogen	1,872	2,940	1,685	6,496	67.8%
Oxygen	27	52	25	104	1.1%
Carbon dioxide	235	578	212	1,025	10.7%
Water vapor	1,131	399	423	1,953	20.4%
Total	3,265	3,969	2,344	9,578	100.0%
Total flow at 2,000 F				44,455	acfm

Combustion air required

127,947 scfh

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Delac Chamber Balance - 6.0% Volatiles



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Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Calculation Assumptions

Feed assumptions		
Average feed rate desired		37,931 lb/hr
Based on breakdown below, aluminum melted wi	ll be	33,000 lb/hr
Feed Content		Wt %
Aluminum		87.0%
Volatiles		6.0%
Moisture		5.0%
Fines		2.0%
Aluminum heat properties		
Melt point	657 C	1,215 F
Heat of fusion		169.0 BTU/lb
Solid specific heat		
Average 60 F to melt point		0.248 BTU/lb F
Average 61 to 579		0.225 BTU/lb F
Liquid specific heat		0.260 BTU/lb F
	sg	
Solid density	2.671	166.7 lb/ft ³
Liquid density	2.375	148.2 lb/ft ³
Heat content of fuels		
Heat content of volatiles	7,778 kcal/kg	14,000 BTU/lb
Natural gas heat content (lower heat value)	8,236 kcal/sm ³	925 BTU/scf
Natural gas gravity vs air		0.60
Natural gas higher heat value (reference only)		1,020 BTU/scf
Operating temperatures		
Melt furnace air temperature	1,093 C	2,000 F
Melt furnace aluminum temperature	779 C	1,435 F
Delac furnace air temperature	482 C	900 F
Delac furnace metal temperature	427 C	800 F
Baghouse inlet temperature	204 C	400 F
Average indoor/aluminum temperature	21 C	70 F
Assumed metal entering temperature = indoor	21 C	70 F
Heat losses from refractory		
Heat loss from delac refractory	192,527 kcal/hr	764,000 BTU/hr
Heat loss from melt furnace refractory	282,238 kcal/hr	1,120,000 BTU/hr

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Calculation Assumptions

Thermal properties of volatiles

Approximate volatile thermal properties with that of oil		
Specific heat of liquid	0.56 kcal/kg C	0.56 BTU/lb F
Heat of vaporization	61.1 kcal/kg	ិ ី 110.0 BTU/lb
Specific heat of gases	0.60 kcal/kg	0.60 BTU/lb F
Assumed boiling point	93 C	200 F

BTU/scf air for volatile combustion at 2% to 3% O₂ in exhaust

93 BTU/scf air

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Delac Chamber Balance - 6.0% Volatiles

Average throughput of fe	eed	37,931 lb/hr
Breakdown		
Aluminum	87.0%	33,000 lb/hr
Volatiles	6.0%	2,276 lb/hr
Moisture	5.0%	1,897 lb/hr
Fines	2.0%	759 lb/hr

Heat to components of feed in the chamber (not including melting in aluminum bath

Stage 1: Feed Heating and Delac Aluminum Heat Start temperature Final temperature dT Specific heat Heat required (at 33,000 lb/hr)			70 F 800 F 730 F 0.248 BTU/lb F 5,974,320 BTU/hr	
Volatiles (no combustion at this time) Heat Start temperature Vaporization temperature Final temperature			70 F 200 F 900 F	
	Specific heat BTU/ lb F	dT F	BTU/lb	
Heat to vaporization	0.56	130	72.8	
Latent heat	0.50	130	110.0	
Heat from vaporization to final	0.60	700		
Total unit heat	0.00	700_	602.8	
Heat required (at 2,276 lb/hr)			1,371,890 BTU/hr	
rieat required (at 2,270 lb/fil)			1,371,090 010/111	
Moisture Heat				
Start temperature			70 F	
Vaporization temperature			212 F	
Final temperature			900 F	
	Specific heat BTU/ lb F	dT F	BTU/lb	
Heat to vaporization	1.00	142	142.0	
Latent heat			970.3	
Heat from vaporization to final	0.477	688	328.1	
Total unit heat	···	_	1,440.4	
Heat required (at 1,897 lb/hr)			2,731,794 BTU/hr	
1 \			, ,	

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Delac Chamber Balance - 6.0% Volatiles

Fines Heat				
Start temperature			70	F
Final temperature (assumed to leave with	gases)	sessor and	900	F
dT			830	F
Specific heat			0.248	BTU/lb F
Heat required (at 759 lb/hr)			156,154	BTU/hr
Summary of feed heat loads				
Aluminum			5,974,320	BTU/hr
Volatiles			1,371,890	
Moisture			2,731,794	
Fines		_	156,154	-
Total heat requirement for materials			10,234,158	BTU/hr
Add heat losses through refractory			764,000	BTU/hr
Total heat requirement, not including melting	ng	_	10,998,158	
•				
First pass, assume this is provided by natu	ral gas firing			
Stoichiometric A/F ratio			9.6	to 1
Assume excess air in burner			5%	
As fired air to fuel		10.08	scf air/scf gas	
Heat required to heat 1 scf of gas to delac	е	-26.65	BTU/scf gas	
Heat required to heat air to delac gas temp		-156.91	BTU/scf gas	
Heat from gas fire (LHV)			925	BTU/scf gas
Net heat from gas firing to delac gas temper	erature		741.44	BTU/scf gas
Gas flow required			14,834	scfh
Combustion air required			149,523	
Compaction all required			110,020	00111
Stage 2: Aluminum melting in bath				
Aluminum to be melted			33,000	lb/br
Metal temperature at start			800	
Melt point			1,215	
Final flowing temperature			1,215	
i mai nowing temperature	Specific		1,233	1
	heat BTU/			
	lb F	dT F	BTU/lb	
Heat to melt point	0.248	415	102.9	
Heat of fusion			169.0	
Heat of liquid to temp	0.260	80	20.8	
Total unit heat requirement		- · · -	292.7	
·				
Heat required from aluminum bath			9,659,760	BTU/hr

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Delac Chamber Balance - 6.0% Volatiles

Aluminum hot bath temperature	Э			1,435 F	
Mixed temperature				1,295 F	
dT				140 F	
Specific heat of liquid				0.260 B	TU/lb F
Unit heat of molten aluminum				36.40 B	TU/lb
Molten aluminum flow required				265,378 lb.	/hr
Ratio of recirculated aluminum	to melted alur	ninum		8.0 to	1
Assumed density of aluminum	liquid			148.2 lb	/ft ³
Volume flow is then				29.84 ft ³	³ /min
				223.3 ga	al/min
Exhaust flow from chamber					
Burner flow				2,739.3 sc	rfm
Moisture from feed		1,897 lt	o/hr	676.1 sc	:fm
Volatiles		2,276 lt	o/hr	121.7 sc	:fm
assumed molecular weight of	volatiles	120			
Total volumetric flow in gas stre	eam		_	3,537.1 sc	rfm
Flow at delac temperature		900 F	:	9,076 ac	ofm
Review gas breakdown	MW	lb/hr	by wt	scfm	by vol
Nitrogen	28	8,590.8	53.7%	1,968.7	55.7%
Oxygen	32	144.0	0.9%	28.9	0.8%
Carbon dioxide	44	1,695.3	10.6%	247.2	7.0%
Water vapor	18	3,283.6	20.5%	1,170.5	33.1%
Volatiles	120_	2,275.9	14.2%	121.7	3.4%
Total		15,989.5	100.0%	3,537.1	100.0%

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Furnace Melt Chamber Balance - 6.0% Volatiles

Incoming materials Temperature of gas stream			900	F
Gas stream	lb/hr	scfm		
Nitrogen	* 8,591	1,969		. ರ ಮುಂದು ತರ್ಕಾರ್ಯ ಮಹುದು ರಾಜ್ಯ ಮತ್ತು ನಿರ್ವಹಿಸಿ ನಿ
Oxygen	144	29		
Carbon dioxide	1,695	247		
Water vapor	3,284	1,171		
Volatiles	2,276	122		
Total	15,989	3,537		
Target chamber temperature			2,000	F
Heat to heat gases to chamber temperatu	ıre			
Nitrogen			2,658,211	
Oxygen			41,378	
Carbon dioxide			553,165	
Water vapor	Co. Hook		2,013,549	
	Sp Heat BTU/lb F	dT F		
Volatiles	0.60	1,100	1,502,069	
Total	0.00	1,100_	6,768,372	
, otta			0,1.00,01.	
Aluminum (molten)				
Temperature			1,295	F
Target bath temperature			1,435	
dT	lb/hr		140	F
From newly melted material	33,000			
Recirculated material	265,378			
Total molten aluminum flow rate	298,378		0.26	BTU/lb F
Specific heat for molten aluminum			0.20	ם ו טווט ר
Heat required to heat aluminum is then			10,860,960	BTU/hr
·				
Summary of heat required				
Incoming gases from delac chamber			6,768,372	
Aluminum			10,860,960	
Refractory heat losses		_	1,120,000	
Total heat load in melt furnace			18,749,332	B1U/nr
Less heat from volatiles			2,276	lb/hr
x heat value of volatiles			14,000	
Heat from volatiles			31,862,069	
Heat release per scf of combustion air for	volatiles		93	BTU/scf
Air required for volatile combustion			342,603	scfh
			25,695	
Unit heat required to heat this air to cham	ber temperature		511.86	BTU/lb

Gillespie and Powers, St. Louis, MO Coated Scrap Furnace System Furnace Melt Chamber Balance - 6.0% Volatiles

Heat required to heat this air to chamber temperature	13,152,236 BTU/hr
---	-------------------

Heat from volatiles net of combustion air heat requirements 18,709,833 BTU/hr

Balance of heat from the burner system	39,499 BTU/hr
Review natural gas firing	
Stoichiometric A/F ratio	9.6 to 1
Assume excess air in burner	5%
As fired air to fuel	10.08 scf air/scf gas
Heat required to heat 1 scf of gas to delac gas temperature	-80.74 BTU/scf gas
Heat required to heat air to delac gas temperature	-386.96 BTU/scf gas
Heat from gas fire (LHV)	925 BTU/scf gas
Net heat from gas firing to delac gas temperature	457.30 BTU/scf gas
Gas fire required	86 scfh
Combustion air required	871 scfh

		From			
	From Delaq	Volatile	From Gas	Total Flow	
Flow from system	scfm	Comb. scfm	Comb. scfm	scfm	% by volume
Nitrogen	1,969	4,511	11	6,491	68.2%
Oxygen	29	79	0	108	1.1%
Carbon dioxide	247	887	1	1,136	11.9%
Water vapor	1,171	612	3	1,786	18.8%
Total	3,415	6,090	16	9,521	100.0%

Total flow at 2,000 F 44,193 acfm

GP BID BC-8175

ALCOA WARRICK

CSM PROJECT

CSM FURNACE EDUCTOR FLOW MODEL

APPENDIX 2

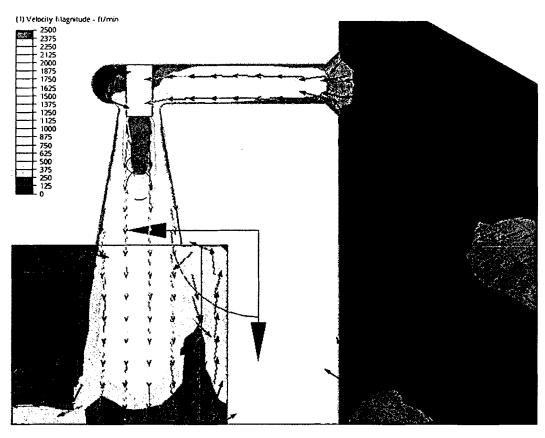


Figure 1.1 EDUCTOR FLOW

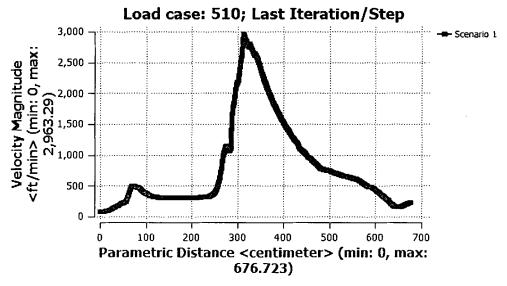


Figure 1.2 EDUCTOR VELOCITY PLOT

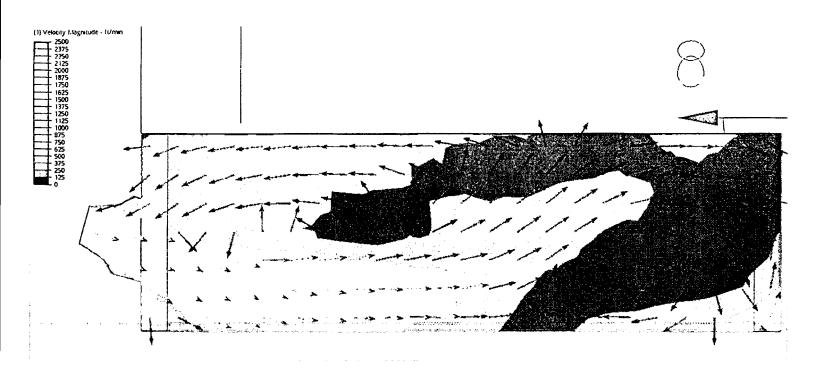


Figure 2.1 MAIN CHAMBER BURNER FLOW

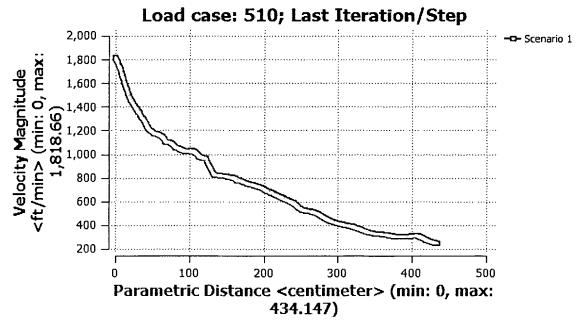


Figure 2.2 MAIN CHAMBER BURNER VELOCITY PLOT

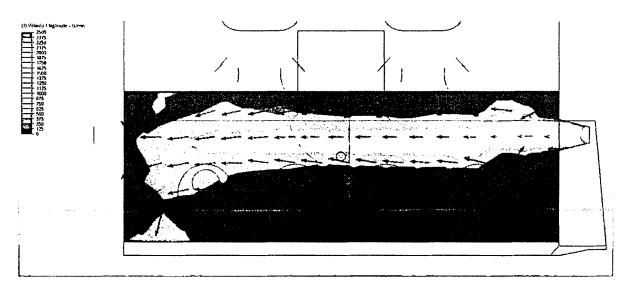


Figure 3.1 DRY HEARTH BURNER FLOW

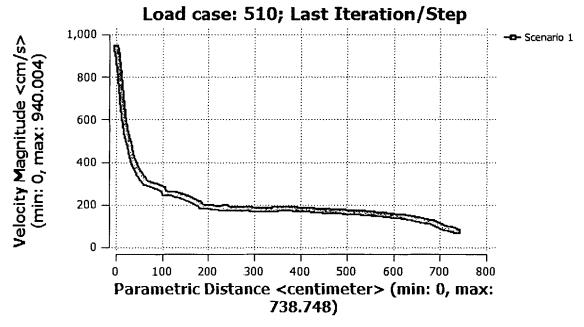


Figure 3.2 DRY HEARTH BURNER VELOCITY PLOT

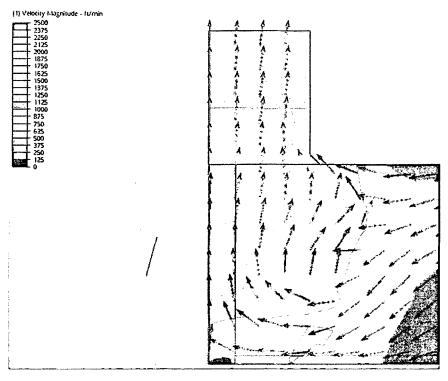


Figure 4.1 FLUE FLOW

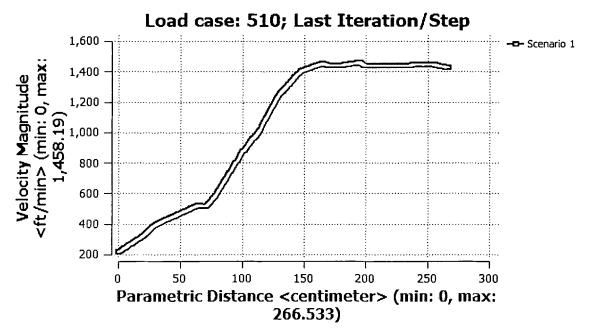


Figure 4.2 FLUE VELOCITY PLOT

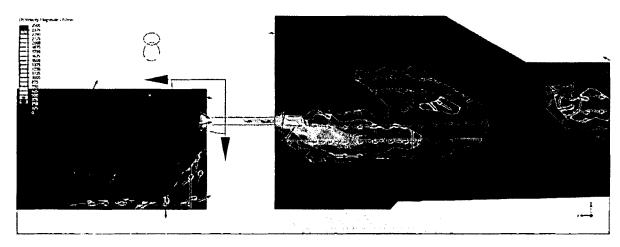


Figure 5.1 CROSSOVER FLOW

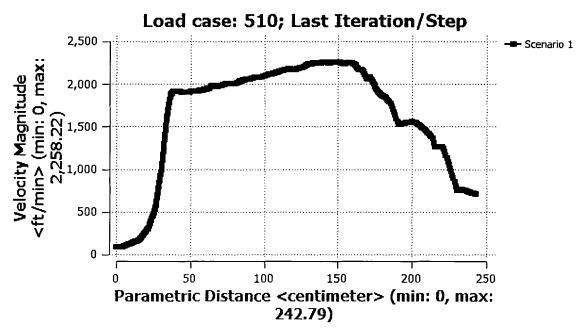


Figure 5.2 CROSSOVER VELOCITY PLOT

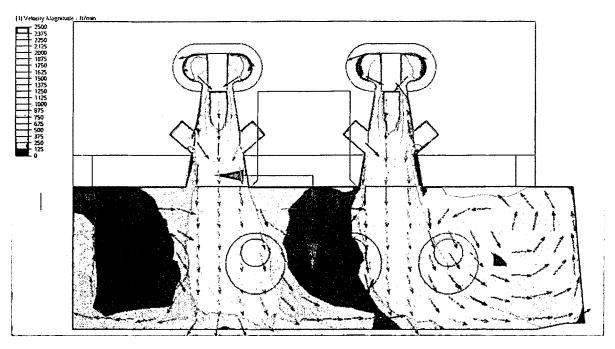


Figure 6 EDUCTORS FLOW

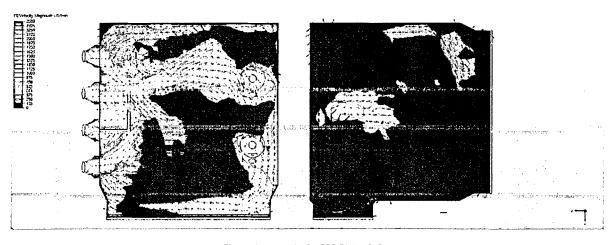


Figure 7 MAIN BURNERS PLAN FLOW

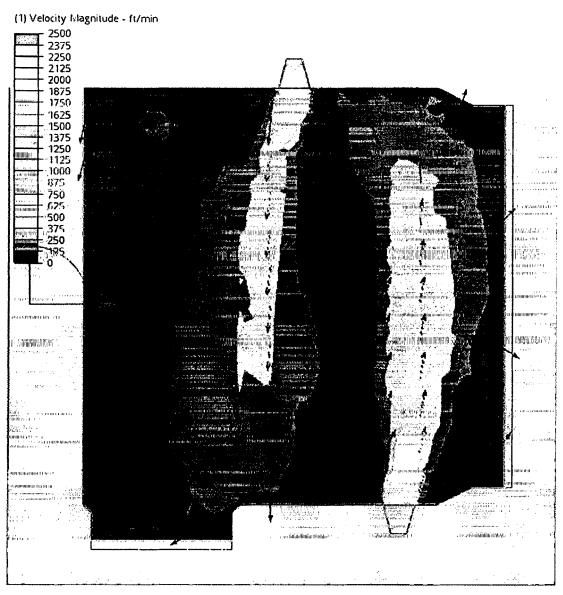


Figure 8 DRY HEARTH BURNERS PLAN FLOW

GP BID BC-8175

ALCOA WARRICK

CSM PROJECT

REFRACTORY HEAT FLOWS

APPENDIX 3







Customer:	BC-8175 Alcoa Warrick CSM	Date	5/11/2018		
Vessel Type:	Floor	Shell Geometry	: Vertical Plat	te	-
		Thermal Dimensions	:		······································
Hot/Face/Temp °F	Material	Thickness (in)	K-Value	Mean Temp.°F	Resistivity
140	00 ARMORKAST 80AL	C 13.50	15.49	1294	0.8713
118	88 Alugard H&B	9.50	5.60	981	1.6973
. 77	75 Greenlite-45-L AL	6.00	2.75	509	2.1842
Heat Flux:	243.5 BTU/Hr ft²	Shell Temp	: 243 °F	Freeze plane	of 1220 °F ·
Ambient Temp:	180 °F	Wind Velocity	: 2 mph	Occurs at 11.	45 (in)
Vessel Temp:	1400 °F	Cold Face Emissivity	: .97	of ARMORKA	ST 80AL C

Due to lack of data, ARMORKAST 80AL C substituted for Alugard RHB







	BC-8175 Alcoa Warrick CSM	Date:	5/10/2018		
Vessel Type:	Lower Side Walls	Shell Geometry:	Vertical Plat	te	AND A THE
		Thermal Dimensions:			
Hot Face Temp °F	Material	Thickness (in)	K-Value	Mean Temp °F	Resistivity
140	00 Matriflo 85ACX	18.00	17.31	1269	1.0398
113	9 SF 607 Board	2.00	0.52	657	3.8403
Heat Flux:	251.16 BTU/Hr ft²	Shell Temp:	174 °F	Freeze plane	of 1220 °F
Ambient Temp:	70 °F	Wind Velocity:	d Velocity: 0 mph Occurs at 12.41 (in)		l1 (in)
Vessel Temp:	1400 °F	Cold Face Emissivity:	.97	97 of Matriflo 85ACX	







Customer:	BC-8175 Alcoa Warrick CSM	Date:	5/10/2018		
Vessel Type:	Upper Side Walls	: Shell Geometry:	Vertical Plat	e	
		Thermal Dimensions:	,		
Hot Face Temp °F	Material	Thickness (in)	K-Value	Mean Temp °F	Resistivity
210	00 VERSAFLOW 55/AR	15.50	12.51	1935	1.2394
177	0 TR-19 Block	2.00	0.99	1501	2.0144
123	3 Fibrex 1900 Block	2.50	0.63	706	3.9517
Heat Flux:	266.54 BTU/Hr ft²	Shell Temp:	179 °F		
Ambient Temp:	70 °F	Wind Velocity:	0 mph	\[\frac{1}{2}	
Vessel Temp:	2100 °F	Cold Face Emissivity:	.97	***************************************	

Due to lack of data, VERSAFLOW 55/AR substituted for Versa-Tech 55 AR HS

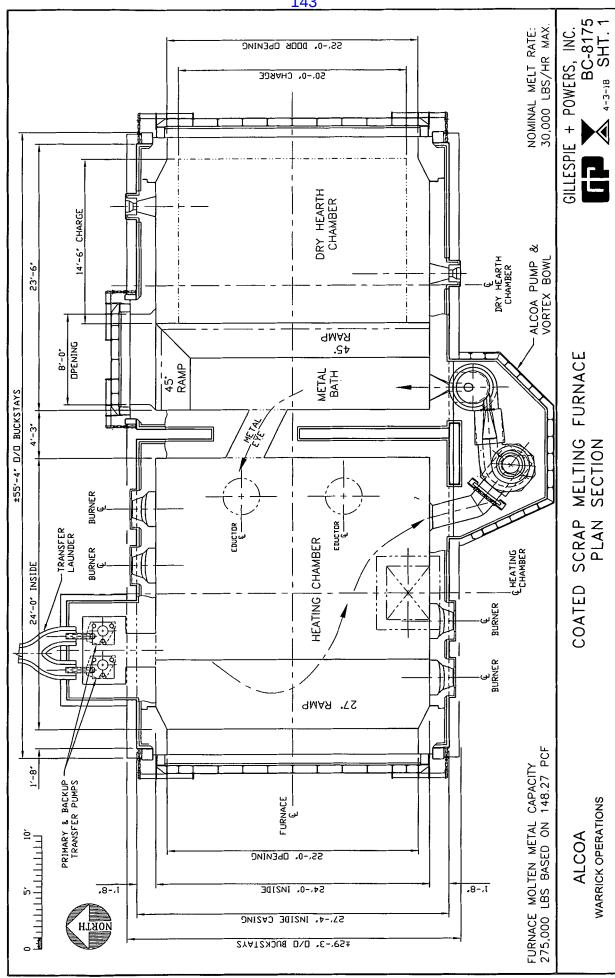


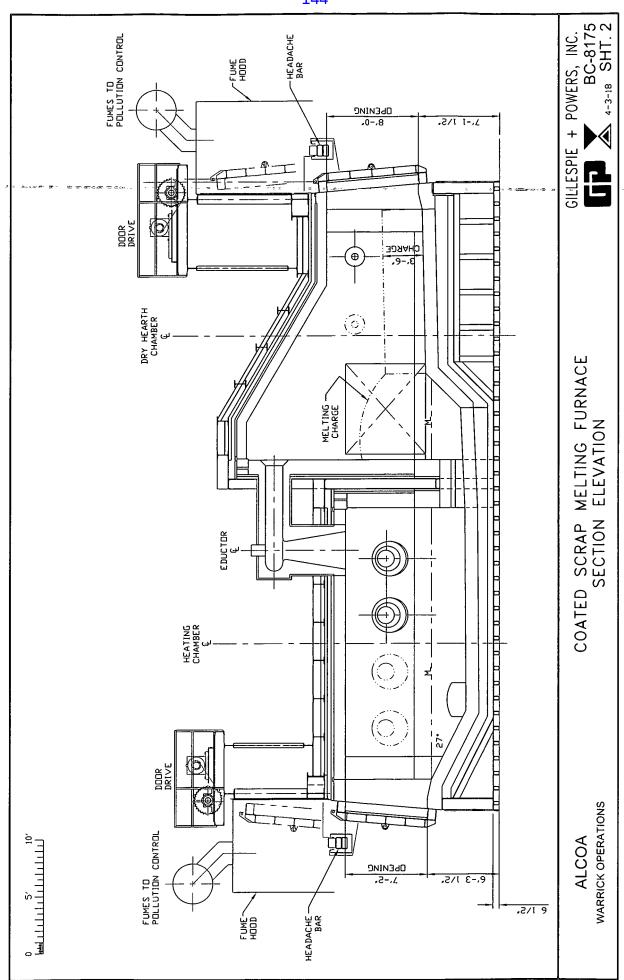


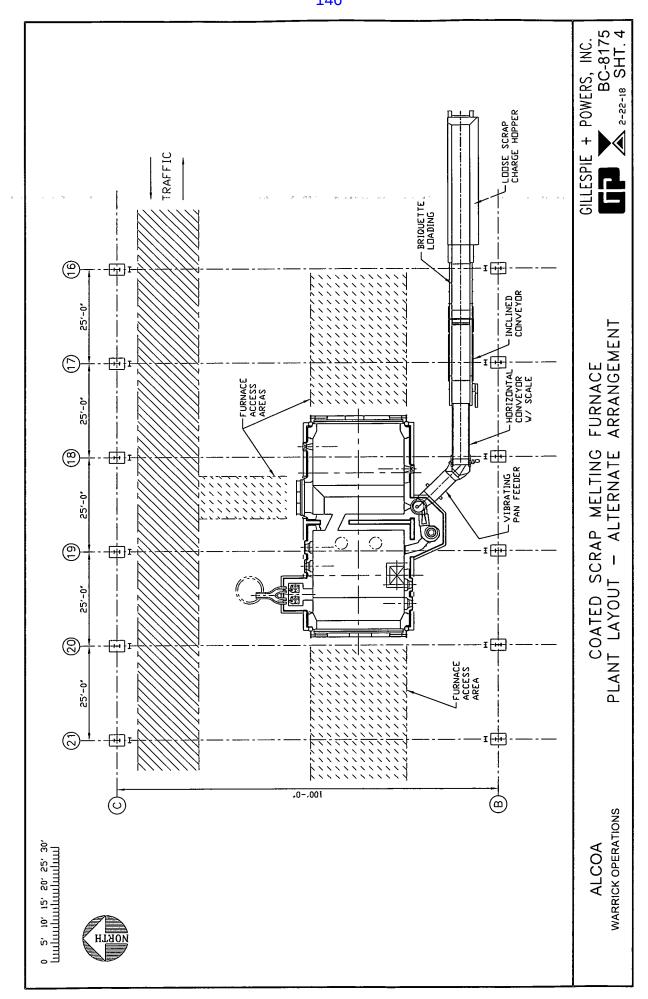


Customer:	BC-8175 Alcoa Warrick CSM		Date:	5/10/2018		
Vessel Type:	Roof	of Shell Geometry: Horizontal Plate Roof		Shell Geometry: Horizontal Plate Roof		
	<u> </u>	Tr	ermal Dimensions:			
Hot Face Temp °F	Material ·		Thickness (in)	K-Value	Mean Temp °F	Resistivity
210	00 VERSAFLOW 55/A	4R	12.00	12.35	1828	0.9717
155	56 Lite Wate 20/35		3.00	1.28	902	2.3381
Heat Flux:	559.48 BTU/Hr ft²	•	Shell Temp:	248 °F		
Ambient Temp:	70 °F		Wind Velocity:	0 mph		······································
Vessel Temp:	2100 °F	Co	old Face Emissivity:	.97		

Due to lack of data, VERSAFLOW 55/AR substituted for Versa-Tech 55 AR HS







Order-Release#

270495663

Order Date

CHANGE ORDER

ALCOA CORPORATION

Supplier No

3000315

Phone

(314) 423.9460

Fax

(314) 428.4431

Supplier Contact IAN MARSH (314) 423.9460

Supplier

GILLESPIE & POWERS INC 9550 TRUE DRIVE SAINT LOUIS, MO 63132

United States

21-AUG-18 **Original Buyer** A CAPITAL **Revision Date** 23-AUG-18 **Revision Buyer** A CAPITAL

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of

Revision

Fax

Buyer Contacts

Phone **Email** capitalbuyer@alcoa.com

lists, cartons, and correspondence related to this order

Ship To Alcoa Warrick LLC CR BLDG 47 (SS134-17) Bill To PO BOX 981258 El Paso, TX 79998-1391

FOB

The above purchase order number must appear on all invoices, packing

This PO incorporates by reference agreement number CW2074696AL

4400 W STATE ROUTE 66 Newburgh, IN 47630 **United States**

United States Phone Fax

Phone Fax

(812) 853-6111 (812) 853-4122

Gov. Contract#

Priority Rating#

Ship Via Freight Terms

Freight Collect

Destination-TitleTransfer

Payment Terms Currency **NET 30 DAYS** USD

Alcoa requires suppliers to utilize the BestTransport Supplier Connection Portal for shipments meeting the conditions set forth below:

Supplier Criteria for using BestTransport Supplier Connection

- * Alcoa Corporation responsible for freight payment to the carrier.
- * For shipments within North America (excluding inter and intra Mexico)
- * For single shipments weighing 150 lbs. or more
- * For motor carrier service shipped as Van, Flat Bed, or LTL.

Alcoa suppliers are to register with BestTransport Supplier Connection at http://supplier.bestshippers.com. To register, click on the Create Account button and enter the Alcoa account key 4alcoa (the key is case sensitive) and click the Submit button.

For assistance creating an account, entering shipment information, or shipment questions or problems, suppliers should contact Alcoa Central Dispatch at 1-866-209-3737 option 6 or via email at AlcoaCorpCD@alcoa.com. For assistance in French, contact the Transportation Group at 1-819-294-3036 or by email at DL-NerDepartementTransport@alcoa.com.

BestTransport Supplier Connection SHOULD NOT be used for urgent, over-dimensional, or any other shipment that requires special handling. Please contact Alcoa Central Dispatch or the Transportation Group for assistance.

Shipments weighing less than 150 lbs. with a destination in the United States are to be routed directly using Fed Ex Small Package, referencing the appropriate Alcoa Shipper Account Number. Shipments weighing less than 150 lbs, with a destination in Canada are to be routed directly using UPS Small Package, referencing the appropriate Alcoa Shipper Account Number.

PLEASE CONFIRM THIS PURCHASE ORDER TO USBuyandPaymentCenterGPP&ATC@alcoa.com In order to avoid short payment issues, please do not ship until you receive a revised PO. Our system does not allow us to update the price on POs after a receipt has been entered.

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CHANGE ORDER

ALCOA CORPORATION

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Supplier GILLESPIE & POWERS INC

PRICING

Please review this Purchase Order carefully. If prices, quantities, part numbers, and/or descriptions are not accurate, please contact the BUYER OF RECORD immediately.

ΤΔΥ

DO NOT charge state sales/excise/use tax as these purchases are direct pay under Indiana Authorization # 0158155386-001

RECEIVING HOURS

Warrick Operations: Monday through Friday, 7:00am thru 1:30PM CST (unless otherwise instructed).

SHIPMENTS

Please also review shipping instructions listed above.

- 1. Shipment and paperwork must be marked with the Purchase Order number and Company name.
- Packing list must be included and placed on outside of package.
- For FEDEX shipments:

Warrick Operations: Bill to Alcoa account number: ***** 742696383 ***** Billing zip code: 47630.

- 3. Direct any collect freight bills to: Alcoa, C/O IPS World Wide, PO Box 982262, El Paso, TX 799982
- 4. Shipments must be CONEG compliant. Supplier assures all materials purchased for use in packaging comply with the CONEG Model Legislation regarding heavy metals in packaging materials.
- 5. FDA PACKAGING ¿ In the case where this material is to be used in packaging of articles or materials that will come in contact with food, acceptance of this order is conditioned on your assurance that the material covered herein is of suitable purity to be used in packaging and protecting articles or materials which come in contact with food.
- 6. Supplier shall not make any shipment containing loose Polystyrene Packing Material.
- 7. Shipments containing wood packaging material imported into the USA must comply with 7 CFR 319.40, Importation of Wood Packaging Material, Effective 9-16-05.
- 8. ¿ ASBÉSTOS: ALCOA CORP WILL NOT ACCEPT ANY MATERIAL CONTAINING ASBESTOS. IT IS UP TO THE SUPPLIER TO ASSURE THAT NO PRODUCT FURNISHED TO ALCOA CONTAINS ASBESTOS. ¿.

QUALITY REQUIREMENTS

1. System Requirements - The supplier's quality system shall comply, at a minimum, with the requirements of ISO 9001 (current revision). The supplier's quality system shall be available at all times for review and approval by Alcoa Corp personnel.

2. Substitution of Material / Subcontracting Material or service - Supplying substitute material or service or subcontracting of any

portion of this work is not permitted unless approved by Alcoa in writing.

- 3. Changes The supplier must notify Alcoa Corp prior to making any significant change(s) to the process or product. This notification must include information regarding the expected performance difference(s) in the material or process due to the proposed change(s). Alcoa Corp reserves the right to require qualification material be supplied to verify process impact prior to receipt of order quantities.
- 4. Right of Access For quality audit purposes, Alcoa Corp, Alcoa Corp's customer and regulatory agencies will have access to approved supplier's facilities including subcontractor facilities with appropriate notifications for the purpose of verifying the quality of the product or service. This includes access to all facilities involved in this order and all applicable quality records including those of the calibration system.
- 5. Record Retention (General) Supplier must maintain all quality records relating to the production/processing of this order for a minimum of 7 years after the material has been shipped. If this requirement cannot be met, the quality records must be transferred to Alcoa Corp at the completion of the work.
- 6. Non-Conforming or Discrepant Material If material delivered to Alcoa Corp is found to be non-conforming, supplier must provide all necessary information for traceability purposes and obtain, in writing from Alcoa Corp Procurement, acceptance or rejection of the material. When a corrective action is deemed necessary, the supplier will receive a corrective action request (CAR) form. The supplier must provide a written response within 14 working days documenting root cause, corrective actions taken, effective date and signature of quality assurance representative. Delinquency on or no response to corrective action requests may cause reevaluation of supplier's quality system's approval and may preclude issuance of new purchase orders/contracts.

MATERIAL SAFETY DATA SHEETS (MSDS)

MSDS must be supplied at the time of the initial shipment of the hazardous material to Alcoa Corp, preferably by mail. MSDS must

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ALCOA CORPORATION

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Supplier **GILLESPIE & POWERS INC**

> also be supplied at the time of the next order request after the MSDS has been revised, reviewed, or otherwise modified by the manufacturer.

INVOICES

It is very important that your invoice match this PO, otherwise payment will be delayed.

Payment terms are understood to be in reference to payment days following approval of the invoice.

Invoices may be submitted by mail OR email. Select only one method of invoice transmission.

Via Email: The following information must be used when submitting an invoice via email.

Email Address: alcoa.mailroom@conduent.com Subject Line: NAPM/PO/RDE PROCESSING

Reference PO Box 981258 in the text of the invoice cover page.

Via Mail: Alcoa Corporation Purchase Order Number: INSERT PO NUMBER PO Box 981258 El Paso, TX 79998

For all invoices, the invoice must include the purchase order number, the invoice number, the invoice period, the Supplier is name, and the Supplier's remit-to address on the first page of the invoice.

If ¿Bill To¿ states ¿PFR NO INVOICE REQUIRED,¿ please do not invoice Alcoa. Payment will be based on received weights and/or packing slip information

Credits must be submitted as a separate credit memo stating the correction to the prior invoice number and reason for the credit. Do not include the credit on the next invoice

Supplier inquiries about invoice / payment processing should be directed to Customer Support via email at USBuyandPaymentCenterGPP&ATC@alcoa.com. In addition, Suppliers can check on the status of payments by using http://alcoadirect.com.

US CUSTOMS REASONABLE CARE STANDARDS REQUIREMENT

Itemized invoice and NAFTA certificate of origin (if applicable) must accompany shipment. Documents must contain the following details: purchase order #, model #, Dimension of crate/carton, serial #, weight per piece, description, ship from Location, country of origin, ship to location, ship date, purchase price, expected Delivery date, harmonized tariff #, carton/crate # item packed in, note: we will assist you if you do not know the harmonized tariff number. Contact Amador Cardenas at 865-695-4585 prior to making shipment. The harmonized tariff number must be on the Shipping invoice.

ALCOA¿S US IMPORT BROKER CONTACT:

Livingston International 3625 NW 82nd Ave, suite 107 Miami FL 33166 attn: team 17 alcoaimports@livingstonintl.com

PH: (305) 219-5548

COUNTRY OF ORIGIN REQUIREMENTS

1. Country of Origin Marking: The producer and /or foreign exporter must comply with the U.S. Customs and Border Protection Marking requirements (19 CFR 134- see below) by indicating clearly the country of origin in which the goods were produced on

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Supplier
GILLESPIE & POWERS INC

each article and outer package.

2. The requirements of 19 U.S.C. 1304 and 19 CFR Part 134 provide that imported articles or their containers must be marked in a conspicuous place as legibly, indelibly and permanently as the nature of the article or container will permit, in such a manner as to indicate to an ultimate purchaser in the United States, the English name of the country of origin of the article.

Order acknowledgement, please sign and return.

Accepting Company:

Title:

Representative (Please Print):

Signature:

Payment schedule in accordance with the commercial proposal

ne#	Item# Description	Rev#	Quantity	UOM	Taxable	Unit Price	Extended Price	Need Date
1					N		0.00	29-MAY-20
****	Engineering Services for th 10, GP Commercial Propos						Addendum Log No	29-MAY-20
Thi	s Purchase Order line CANCE	LLED on				23	B-AUG-18.	*
The	e Original Quantity Ordered						531281.25	*
	antity CANCELLED						531281.25	*
Shi	рТо							
	Shipment # 1 Address at top of page							
	This ship CANOCI I CD	******	********	*****	******	***********	**************************************	
	This shipment CANCELLED	חכ				23	-AUG-18 531281.25	
	•							
	Original Shipment Quantity Quantity CANCELLED						531281.25	*

2

N

0.00

29-MAY-20

Down-payment for GP to order materials for the Coated Scrap Melter Project per attached Alcoa RFQ R1, Addendum Log No 10, GP Commercial Proposal R6, Technical Proposal R1, and Schedule R2.

29-MAY-20

CHANGE ORDER

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Purchase Order Total

2,200,290.00

Supplier

GILLESPIE & POWERS INC

ine#	Item# Description	Rev#	Quantity	UOM	Taxable	Unit Price	Extended Price	Need Date
****	************	******	******	******	******	******	*****	
This	Purchase Order line CANCEL	LED on				23-	AUG-18	*
The	Original Quantity Ordered					1	669008.75	*
	ntity CANCELLED	******	******	*****	*****		669008.75	•
Line	will be added as 3-way MATC	Н						
Ship	то							
/	Shipment # 1 Address at top of page							
	This shipment CANCELLED on		•	******	******		AUG-18	*
	Original Shipment Quantity						1669008.75	*
	Quantity CANCELLED						1669008.75	*
•	***********	******	*****	******	*****	********	******	
- 1	Deliver To: HAYNES, TERR	Y A [Terry.Hayne	es@Alcoa.com]			(1.669.008.75)
3	•				N		531,281.25	29-MAY-2
	Engineering Services for the 10, GP Commercial Proposal						Addendum Log No	29-MAY-2
Shi	ір То							
	Shipment # 1 Address at top of page							
	Deliver To: HAYNES, TERF	RY A [Terry.Hayr	nes@Alcoa.cor	n]			(531.281.25)	
4					N		1,669,008.75	29-MAY-2
	Down-payment for GP to ord Addendum Log No 10, GP Co							29-MAY-2
Shi	рТо							
	Shipment # 1 Address at top of page							
	Deliver To: HAYNES, TERF	Y A ITerry Have	nes@Alcoa cor	nl			(1,669,008.7	5)
	20		.55.66, 11000.001				(1.000.000.7	<i>,</i>

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AL	COA	COF	RPO	RAT	ION
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SUPPLIER SILLESPIE & POWERS INC		١.	23-AUG-10		ACAFIIAL			
Line#	Item# Description	Rev#	Quantity	UOM	Taxable	Unit Price	Extended Price	Need Date
	e i server i a i	113- 2 577 6		· · · · · ·	- - 	<u> </u>		
Ву			B	Buyer				Date



REQUEST FOR QUOTATION FOR PROCUREMENT OF GOODS AND SERVICES

Bid Requirements and Submittals

General

Contractor evaluation and selection will be based on a combination of factors:

- Lump sum turnkey price for entire CSM Complex as outlined below.
- Alcoa intends to issue two (2) purchase orders for this work. One for Engineering and one for fabrication, build and installation. All to one turn-key contractor!
- A mandatory on-site pre-bid meeting to answer questions and to examine the
 work area and plant layout is required. Failure to attend the pre-bid meeting
 shall disqualify the Contractor from this project. All questions will be
 addressed at the Pre-Bid meeting, or with written correspondence to all
 attendees before the bid due date.
- Contractors shall provide supporting documentation to demonstrate experience and capability in performing similar work.
- Schedule This project is a cost saving to Alcoa production cost once this
 equipment becomes operational. It is imperative that the engineering for
 these changes are completed in a timely fashion so construction of the site
 preparation can commence as soon as funding is approved.
- Safety record, (EMR)
- Safety performance evaluations at Alcoa facilities
- Quality performance evaluations at Alcoa facilities
- Plan of work, brief description of how you plan on completing the work
- Rate structure for Time and Material work.

Bid Evaluation Submittals

The submittals listed below are required deliverables for bid consideration and evaluation.

- Firm Price Lump Sum Bid
- Critical Milestone Schedule that includes the below:
 - o Preliminary design drawings for review.
 - o Submittal of Approval Drawings
 - o Purchase order placement for long lead items
 - o Proposed delivery schedule
 - o Submittal of Sub-Contractor(s) work
 - o Submittal of Construction Scope of Work
- Alcoa work experience (Description of Work & Date)
- Alcoa Warrick Operations work experience (Description of Work & Date)
- Plan of work, brief description of how you plan on completing the work
- Safety Record Evaluation (EMR)
- Resume of Project Supervision and Safety Professional



Sample; Contractors Safe Work Plan

BID INSTRUCTIONS:

- 1. The site visit is scheduled for February 06, 2018 at 8:00 am in Bldg. 134F, Room 207, at Alcoa's Warrick Operations. Please submit names of attendees by FEBRUARY 01, 2018 to Terry Haynes so site arrangements can be made.
- 2. A follow-up date for additional site visits, by appointment only, can be schedule with Terry Haynes at 812-489-3820.
- 3. Your firm shall submit your proposal package as indicated in the cover document for your firm's quotation request.
- 4. Contractor shall notify Alcoa of their SPA contact for the bid and all communications shall go through that person.
- 5. Contractor shall use May 3, 2018 as the date a purchase order will be released for proposed project schedule.
- 6. Contractor shall use a fixed amount of 1500 MH. In their proposal bid for Construction Management Contractor interface. After the project contractor is selected and the Construction Management firm is selected, Alcoa will revisit this topic with the project contractor to review.
- 7. Contractor shall provide a Budget Estimate of what they estimate the foundation engineering, material and installations will cost. Do not include as part of the proposal but under separate letter. No piling for Baghouse and "H" piling under furnace. This is for Alcoa estimating purpose.

BIDS DUE BY April 03, 2018, by End of Business Day

Your bid package and all commercial correspondence shall be directed to:

Alcoa

Dennis Sikora Procurement SPA Office: 412-473-2424

Cell: 412-459-1385

Email: dsikora@projectassociatesinc.com

A copy of your bid package must also be sent to:

Terry Haynes

Office: 812-853-4460 Cell: 812-489-3820

Email: terry.haynes@alcoa.com

All communications shall go through Dennis Sikora with a copy to Terry Havnes.

REQUESTED GOODS AND SERVICES:

This AGREEMENT FOR PROCUREMENT OF GOODS AND SERVICES ("Agreement") dated this xxnd day of xxxxxxx, 2018 by and between xxxxxxxxxxx. (Individually and collectively "Seller"), and Alcoa Inc., a Pennsylvania corporation and its Affiliates ("Company").

WHEREAS, Seller wishes to sell Products and Services (defined herein) to Company and Company wishes to order and purchase such Products from time to time

WHEREAS, the parties wish that the terms of this Agreement be utilized by Company Affiliates (as defined below) if Company Affiliates choose to participate in this Agreement by issuing a purchase order and/or participation agreement referencing this Agreement.

NOW THEREFORE, in consideration of the mutual covenants and agreements set forth herein, and for other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, Company and Seller, intending to be legally bound, agree as follows:

- 1. <u>TERM.</u> This Agreement shall commence on the <u>XX</u> day of <u>XXXX</u>, <u>2018</u> and terminate ending after fulfillment of the obligations of both parties, save any obligations that survive termination.
- PARTIES. Seller and Company have negotiated this Agreement pursuant to which Company and Company Affiliates may purchase Products from time to time from Seller and its affiliates in the United States and various countries where such parties wish to transact business. The term "Affiliates" is defined as those subsidiaries or affiliates of Company that enter into this Agreement by issuing an order or, in the case of foreign Affiliates, executing a participation agreement such as a contract addendum that specifies any changes that Seller and such Affiliate(s) agree to make to the Agreement based on local law, local operational practice or other concerns that will apply solely to the performance of this Agreement for the Affiliate(s) that executes the relevant participation agreement. The terms of this Agreement and the applicable participation agreement will apply between Seller and the Company Affiliate and references to "Company" means the Company Affiliate that has executed a participation agreement and placed an order and references to "Seller" means Seller or its local affiliate in each country that provides the Products pursuant to an order. Each order issued by Company or its Affiliate(s) to Seller related to this Agreement and any applicable participation agreement will constitute a separate contract between such parties. Seller will directly invoice each Company location or Company Affiliate that issued the order.
- 3. <u>COMPANY REQUIREMENTS</u>. Seller agrees to sell the equipment and services listed and described in <u>Attachment A</u> ("Equipment and Services") as Company may order, from time to time, at quantities identified in the applicable purchase order and/or participation agreement(s). The Products will meet the specifications more particularly described in <u>Attachment A</u>.
 - 4. PRICE. The price for the Equipment and Services is identified in Attachment B.
- 5. <u>TERMS AND CONDITIONS</u>. The terms and conditions governing purchase orders issued pursuant to this Agreement are set forth in <u>Attachment C</u>.



- 6. FINAL ACCEPTANCE CRITERIA & PERFORMANCE TEST. The final acceptance criteria and performance test requirements set forth in Attachment D shall govern the requirements for final overall acceptance of the Equipment and Services.
- 7. PAYMENT MILESTONES AND SCHEDULE. The parties agree that milestone dates and payments, for the Products, will be as set forth in Attachment E.
- 8. <u>LIQUIDATED DAMAGES</u>. Liquidated damages, as listed in <u>Attachment F</u>, will be calculated and payable by Seller to Company pursuant to the terms and conditions set forth herein.
- 9. <u>SITE SPECIFIC CONDITIONS</u>. The parties agree that they will comply with the site specific conditions set forth in <u>Attachment G</u>.
- 10. <u>RELEASE OF LIENS TEMPLATE.</u> All release of liens, issued pursuant to this Agreement by Seller, shall substantially conform to the Release of Liens template set forth in <u>Attachment H</u>.
- 11. <u>INCORPORATION BY REFERENCE</u>. Attachments A through H are attached hereto, made part hereof, and incorporated by reference herein.
- 12. ENTIRE AGREEMENT. This Agreement together with the Company purchase order, attachments and any applicable participation agreements sets forth the entire agreement between Company and Seller with respect to the subject matter hereof and supersedes and overrides all other prior negotiations, commitments, writings including, but not limited to, terms and conditions contained in any documents provided by Seller in connection with its obligations hereunder. Any references to Seller's quotation, terms and conditions or other form of offer for the Products is for informational purposes only and any attempt by Seller to vary the terms of this Agreement in any degree will be deemed material and expressly objected to and rejected by Company.
- 13. PRECEDENCE OF DOCUMENTS. In the event of any conflict between the attachments of this Agreement, the order of precedence will be as follows:
 - A. This Agreement
 - B. Attachment C Terms and Conditions
 - C. Any specific or special terms set forth on Buyer's PO
 - D. Attachment A Company Requirements
 - E. Attachment D Final Acceptance Criteria & Performance Tests
 - F. Attachment B Price
 - G. Attachment E Payment Milestones and Schedule
 - H. Attachment F Liquidated Damages
 - I. Attachment G Site Specific Conditions
 - J. Attachment H Release of Liens Template



15. <u>NOTICES</u>. All notices required or permitted to be given pursuant to this Agreement or any of the Attachments hereto shall be in writing and shall be valid and sufficient if dispatched by a) registered or certified mail, postage prepaid, in any post office in the United States; b) hand delivery; c) overnight courier; or d) facsimile transmission upon confirmation of receipt.

If to COMPANY:

Alcoa Inc.

201 Isabella Street

Pittsburgh PA 15212

Phone: xxxxxx
Email: xxxxx
Attn: xxxxxx

If to SELLER:

XXXXXXXX

XXXXXXXX

XXXXXXXX

XXXXXXXX

XXXXXXXX

Each party may change its address or other notice information in any respect, by giving written notice to the other party.

16. COUNTERPARTS. This Agreement may be executed in any number of counterparts, which together shall constitute one and the same document

IN WITNESS WHEREOF, the parties have caused this Agreement to be executed by their duly authorized representatives as of the date first above written.

Alcoa Inc.	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX				
Ву:	Ву:				
Name: xxxxxxxxxx	Name: xxxxxxxxxx				
Title:					
Senior Director – Global Capital Procurement	Title: President				



Request For Quotation: CSM-R1 Dated 02-13-2018

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Attachment H - Release of Lien Template

Attachment I - Reference Documents



ATTACHMENT A - COMPANY REQUIREMENTS

A. GENERAL PROJECT DESCRIPTION:

Warrick Operations purchases a large amount of the metal units it consumes to create the finished product that it sells, from "external sources." This specification is to add a means to melt "cold metal units" that can't be consumed elsewhere in the Warrick furnaces.

The metal units that will be consumed by this system will be Class 1, Class 2, and Class 3 scrap that will add up to approximately 180 MM lbs / year. The preliminary breakdown of the scrap type and description in Appendix I "Furnace Scrap Usage Table". The remaining 20 MM lbs/Yr. will be comprised of whatever scrap is available at the time.

This specification is for one (1) cold air gas fired continuous melt furnace. Scrap is to be charged by tubs through the charge bay door. Chips and scalps at ambient temperature will be fed into furnace through proprietary buyer Vortex system to deliver molten metal at desired temperature to downstream holding furnaces where final alloying and casting is performed. This furnace system must be capable of fitting between building columns B14 and C22 in the attached drawing SK-092517-PAI2. This is a footprint of 100 ft. wide x 200 ft. long. The distance between the concrete floor and the bottom of the roof trusses is approximately 39 ft. (29 ft. to the bottom of the overhead crane girder)

This specification covers the requirements for the Engineering, Design, Fabrication, Delivery, Installation, and Commissioning of the equipment at Alcoa's Warrick Operations, Newburgh, Indiana. Unless otherwise noted, Seller shall furnish all labor, supervision, materials, equipment, tools, taxes, insurance, engineering, design, drafting, and all other things necessary to fabricate, deliver, and install the complete furnace complex project at the installation site. This shall include, but not limited to, the following items:

- Furnace fabricated steel work.
- Combustion system & associated hardware.
- Refractory design, material supply, & installation.
- Furnace exhaust and flue system.
- APC Lime Injected Bag House system
- Electrical system, instrumentation, & controls programming.
- Furnace door installation, pneumatics, and associated controls.
- Integration of seller supplied ingestion system with molten metal circulation pumping systems
- Integrated molten metal transfer pump system with backup to transfer metal into
- All associated and required platforms to operate and service the furnace and ancillary equipment
- Conveyor System to charge both scalps and chips from "floor".
- Critical design information for foundation design and utility drop locations by others.
- MCC/PDP panels and buildings needed for equipment electrical feeds.



- Operator control booth.
- All ancillary equipment needed for a complete operation system.
- Alcoa Warrick Operations has similar aluminum melting furnaces. Seller shall
 incorporate "Alcoa Standard" components for the molten metal circulation-system,
 molten metal tapping system, refractory hardware, and several of the baghouse
 components. (Details have been furnished for these items.)

Buyer reserves the right to supply all or part of this scope of supply. Final responsibilities will be clarified in Buyer's purchase order.

As space for this furnace installation is limited, Seller shall make ancillary equipment (furnace control panels, gas train, etc.) stand-alone and as compact as practical, still allowing equipment to be serviced and without impacting specified equipment performance. As adjacent equipment and space is still actively being negotiated, consideration should be made that this support equipment may be located remotely to the furnace.

Alcoa Engineering Standards and applicable industry standards are referenced throughout this document. Any objections to these specifications shall be identified in Seller quotation and project correspondence for consideration and approval of a specification deviation/change order. Failure to identify objections is assumed to indicate acceptance and compliance with stated specifications.

Seller shall adhere to all applicable Alcoa and Warrick Operations Environmental Health & Safety and Security procedures when on Buyer's plant site.

B. GENERAL CONSTRUCTION NOTES

B.1. ENVIRONMENTAL HEALTH & SAFETY

All contractors are required to fully understand, respect, and strictly abide by Alcoa's EHS policy, values and related policy as stated below: (NOTE: Contractor is fully responsible for insuring subcontractors follow all criteria and provide all the necessary training and safety plans.)

Alcoa, Inc. has created a single, Environmental, Health and Safety Value related Policy and Principles. The EHS Value, Policy and Principles clearly and simply articulate Alcoa's Vision with respect to Environmental, Health and Safety. All Contractors and Vendors are expected to understand, promote and comply with the following EHS Value and its related Policy and Principles as they relate to Contractors work at Alcoa.

EHS VALUE:

We will work safely in a manner that promotes the health and well-being of the individual and the environment.



EHS POLICY:

It is Alcoa's policy to operate worldwide in a safe, responsible manner which respects the environment and the health of our employees, our customers, and the communities where we operate. We will not compromise environmental, health or safety values for profit or production. All Alcoans are expected to understand, promote and assist in the implementation of this policy and the accompanying principles.

The Contractor's Management is accountable for the safety and health of the Contractor's Employees. The Contractor is also accountable for the impact that the actions of his employees and subcontractors may have on the safety and health of others.

Attached are copies of the Alcoa Warrick Contractor Site Conditions and the "Warrick Operations Safety & Health Rules 2015" (the almond book). All contractors and subcontractors must adhere fully to all areas of these documents as they pertain to this project. All bids must include all costs associated with following these documents.

All Contractors' employees working at Warrick operations must complete the required training per the regulatory requirements and Alcoa Warrick Operations required Orientations. This includes an 8 hour initial Association of Reciprocal Safety Council orientation (or 4 hour refresher, if applicable) (details to be provided during the site visit meeting) and a 1.5 hour Alcoa EHS orientation.

A Roof Access Permit along with a Roof Access Log must be filled out any time personnel must get on a roof. Contractor must place iso-board and plywood on the roof in any areas where there could potentially be damage to the roof from the work associated with this project. Iso-board and plywood shall be secured if left when contractor is not on-site.

A minimum of one supervisor per shift must go through Alcoa's Hot Work Training class. A trained person must be on-site any time Hot Work is performed. Hot Works Permits must be obtained at the beginning of each shift and must be signed by Hot Works Trained personnel. Plant Protection personnel will review the sites and the procedures each morning with the crew. If conditions warrant, changes must be made. (Designated Hot Works Areas could be set up by working closely with Plant Protection. These areas will not require daily permits.)

The Contractor's employees shall wear hard hats, safety glasses with side shields, hearing protection, and steel toed shoes with internal metatarsal protection while on plant site. Alcoa has a zero tolerance policy on safety violations. Noncompliance can result in removal of Contractor's employee(s) from the job site as well as restriction of the Contractor from work at the site until the situation is remedied. Delays due to safety violations will not be an excuse for the contractor to miss the schedule.

Building cranes can be used by contractor to unload and erect structures provided they have a "card holding" operator and go through the Alcoa training for that crane (approx.4 hr.) prior to use. Contractor cannot leave load on hook overnight or for any long length of time. Alcoa cannot guarantee the crane availability all the time. Contractor should request usage and schedule from Alcoa a minimum of a day in advance. Alcoa production has preference of crane use!

The Contractor shall clearly indicate with his bid, which subcontractors will be used on this job. All subcontractors will require approval by Alcoa and have completed Engineering Standards 33.052.1 and 33.055.1.

EHS Scope:



The contractor must have a Safety Professional with additional Safety Persons for off shift work. They shall spend greater than 50% of their time at the project where work is being performed anytime their workers are on-site. A Resume' of the Safety Professional shall be submitted and approved by the Alcoa's Representative.

Accessing trucks and trailers:

 Fall protection/prevention is required anytime a person is exposed to fall hazard of four (4) feet or more. This includes loads on trailers. Standing on top of a trailer with a 4 foot bed height is prohibited and can result in being banned from site.

Confined Space:

During the work to rebuild the furnace some portion of the work area may be classified as a confined space. The contractor must supply all monitoring equipment for the confined spaces. The monitoring equipment must be one of the Alcoa accepted models. All confined space entry forms must be turned in to the Alcoa Project Manager upon completion. *Refer to the Alcoa EHS standards: 18.1*

If there is a question about whether a confined space exists or not, ask Alcoa's representative.

Tool Box Meetings:

Contractor is responsible to conduct daily toolbox meetings for every employee working on site. Toolbox meetings are to cover safety related topics. Meetings should last a minimum of 10 min. Toolbox meetings must be documented each shift. Copies of all documentation must be turned in to the Alcoa Project Manager upon completion.

Personal Protective Equipment:

The contractor must supply all Personal Protective Equipment. Personal Protective Equipment must be maintained and stored in the proper manner according the related standard. While in the Ingot plant, all personnel shall wear 100% cotton or natural fiber clothing with long sleeve shirts. Well-kept and functional Vinex FR-9B, Oasis, or PR97 clothing (check with your Alcoa contact for material weight options and underclothing requirements) must be worn while working within 40 feet of a furnace that contains molten aluminum if no barriers are in place. Additional Personal Protective Equipment must be worn according to the EHS Safety Plan developed by the contractor, which is approved by the department EHS coordinator. *Refer to the Alcoa EHS standards: 18.1.1, 18.28*

Hygiene:

The contractor is responsible to supply portable toilets, and wash stations. The number of portable toilets and wash stations depends on the maximum number of workers on site at one time. The stations must



be kept in an orderly and clean fashion. Alcoa's potable water is not for human consumption. The contractor must provide drinking water for their employees.

EHS Contractor Safety Plan:

Contractors are responsible to submit a Contractor Safety Plan for the job within 6 weeks of receipt of a contract for installation services. The plan will cover every operation, task, and job that will be done during this project. The plan will list all the hazards associated with the specific task, operation, and/or job. It will also list the safety measures that need to be done to eliminate or reduce the hazards while performing the specific task, operation, and/or job. The plans must be completed before any work can be done and submitted to the Department EHS Coordinator for approval. The preliminary report is to be completed by the Contractor prior to arriving for the pre-job safety meeting. The plan will be reviewed by the appropriate Alcoa EHS and engineering contacts for completeness and compliance to Alcoa Warrick standards. The final report must be approved by Alcoa prior to starting work and a copy must be posted at the job site during work.

Waste:

Contractor is responsible for collecting and placing all waste generated by the work into Alcoa provided containers. Alcoa is responsible for the proper disposal. The Contractor is responsible for coordinating waste management with Veolia (Jason Temme at 853-4103, mobile (812-760-0007) for the types of containers required and the timing for their movement.

Alcoa's Representative will make contact with Trockmans' and Sons to set up a trailer for the scrap steel items. The Contractor will schedule the trailer as needed.

Driving on Site:

All contractors are required to park in the designated area. No vehicles will be permitted in the work area unless they are required to perform work that is needed for this project. All contracted employees will park in the designated areas and walk into the work area. All vehicles regarding shipping and receiving are required to have an escort in and out of the work area. All areas where mobile equipment and pedestrians walk or drive must be segregated according to the Alcoa EHS Standard. Refer to the Alcoa EHS standards: 30.36.1

Emergency Equipment and Services:

The contractor must supply any needed emergency equipment that will be necessary for the furnace rebuild. Portable eye wash stations will need to be installed in areas where work is being performed and the workers do not have access to the ones in the plant. Contractors are also responsible to provide their own medical treatment, physicals, and first aid.



Alcoa can provide emergency EMT services if required. The successful contractor must sign a "Medical Hold Harmless" with Alcoa prior to the start of the project.

Employee Work and Break Areas:

Contractors are required to stay in the designated work areas only. At no time, unless an emergency, are contractors permitted outside of the work area. Contractors are also responsible for supplying their employees with a break area where they can eat and restroom facilities. The location of these facilities is to be determined during the bid meeting.

Chlorine:

Contractor employees are required to have Chlorine Level 2 training prior to working in the Ingot Plant. All documentation must be turned in to the Project Leader upon completion.

Contractors are required to follow the guidelines outlined in the Alcoa EHS Standard regarding Chlorine. Refer to Alcoa EHS Standard: 18.12. Standard 18.12 does not apply to this work because the contractor will not be working on the chlorine system. This contractor shall not work on the chlorine system without permission and direction from Alcoa's representative.

B.2. SITE CONDITIONS & WORK FORCE

Work Force:

The Alcoa Warrick facility is a union facility, but Non-Union construction companies are awarded work at this facility on a "Case-by-case basis" after an evaluation that includes (but not limited to) the following criteria:

- Safety record
- Safety Program
- Technical experience
- Skilled craft
- Economic justification

If Contractor is interested in presenting a proposal that includes a Non-Union work force, Contractor shall submit a "Base Bid" with Union work force, and submit an alternative bid with Non-Union crafts. If there is economic justification to pursue this option, then Alcoa will request the above mentioned additional information.

Contractor shall be liable for and shall pay all Indiana sales and use taxes on all Contractor-furnished materials, machinery, tools, equipment, supplies, and similar items used but not incorporated as a permanent component part of the work.

General:



- 1. The contractor shall be responsible for coordinating scheduling requirements for all needs from the plant through the Alcoa representative.
- 2. The following will be discussed during the site visitation: Scope of Work, scheduling requirements, overhead clearance, access ways, storage locations, crane requirements, etc.
- 3. The General Workmanship Specification contained within this specification shall apply to all applicable construction activities not specifically covered in the scope of work.
- This contractor shall develop a project schedule for this work and revise it as work progresses. The schedule shall be presented to and accepted by Alcoa prior to the start of construction.
- Alcoa representatives and the lead contractor people shall meet twice each week (at a minimum) to discuss progress and issues.
- 6. Contractor shall update Alcoa at least 3 working days before the end of each month to provide anticipated invoicing for the next month and future monthly forecast expenditures.
- 7. Contractor personnel will not be allowed to use Alcoa's restroom or lunch facilities.
 - An area for the contractor's office trailers will be provided in the Alcoa construction area. Power for the office trailer will be made available to the Contractor. Contractor is responsible for hooking up all power to the Project trailers. Contractor will be responsible for providing materials and labor for the installation of temporary power for all site trailers and construction activities such as welding receptacles. Routing for the temporary power must be secured and safe from equipment damage and must be approved by Alcoa Electrical Engineer. Alcoa electricians will land the contractor provided and installed cables on the proper disconnects in the substations. Temporary power for the trailers will be supplied from either SM15 or SM18, depending on the location of the trailers. Power shall be 480 VAC and contractor must provide step-down transformers where needed.
- 8. Locations for Site Trailers, Break Trailers, Storage Trailers, Material Storage, and Laydown Yards will be discussed during the site visit. Note that conventional trailers are not allowed inside or within 25 feet of a permanent structure. Sea-can type trailers must be used for these locations. See attached drawing SK-171013-PAI2.
- 9. Approved travel routes (thru the plant premises) for all Contractor (and Sub-Contractor) employees will be established as part of your Contractor safety planning. This can take the form of an attached map (SK-130813-PAI1) is provide in the specification package) of the area with travel routes marked or written into the safety plan. At a minimum, acceptable travel routes will be identified and become part of your written job safety plan for the following:
 - Getting to and from the job site at the start and end of the shift.
 - Getting to and from the restroom.
 - Getting to and from the break area.
- Alcoa will provide the elevation benchmark survey pins and critical equipment centerlines for the work inside Building 134, after Approval Drawings have been approved by Alcoa Engineering
- 11. Concrete and refractory pour/mix cards shall be submitted by the contractor and signed by the Alcoa representative before any pour is started. These cards must indicate the contractor has verified location of all embeds and the integrity of forms and cleanliness of area to be poured.
- 12. The contractor will receive all of the drawing sets, drawing changes and additions from the Alcoa representative. Contractor to mark up any discrepancy on the construction drawings and provide them for our drawing updates in order to reflect final as-built conditions. Contractor will maintain one complete set of "as built" marked-up drawings throughout the



project and turn the marked-up set of drawings over to Alcoa before Alcoa will sign off for final payment that the job is considered complete.

- 13. Contractor will visit the job site, prior to bid submittal, to observe the site conditions and impediments shown or not shown on supplied drawings.
- 14. Contractor shall employ competent and full-time person(s) to supervise all aspects of this project. They must be present at all times while the Contractor and their sub-contractors are performing work at our job site.
- 15. Contractor is responsible for all materials except for those specifically identified as "Alcoa Provided Items". All material lists on the drawings and in the Bills of Material are "best estimate" only.
- 16. Contractor will work with Alcoa personnel to assure minimal disturbance to plant operation due to their demolition, excavation, and foundation installation work
- 17. The contractor's environmental, health, and safety performance will be audited on-site throughout the project. An Alcoa representative shall document at least one audit between the start and completion of any contracted work. Audits shall be documented according to Alcoa's "Contractors Audit" form (SH-237). There will be at least one unannounced audit per week. The Contractor shall provide Alcoa's Contractor Safety Coordinator a monthly injury summary and report hours worked at Alcoa by utilizing "Contracted Hours/Injury Compilation" form (CP-013) no later than the fifth working day of the following month. This form may be faxed or mailed directly to the Alcoa's Contractor Safety Coordinator.
- 18. Contractor and their Sub-Contractor(s) must maintain a list of employees (in Excel format) along with their work specific training certification status. Examples of job specific training required could be, but not limited to, OSHA, Lock/Tag/Try, Confined Space, Fall Control, Mobile Equipment, etc. Only certified and trained employees must perform the respective job tasks.
- 19. In keeping with our values and commitment to maintaining the safest possible workplace, Alcoa recently conducted a study in the U.S in conjunction with Yale University to determine if there is a relationship between the number of hours worked and the risk of injury. The study looked at both the number of hours worked in a single day, as well as the accumulated number of hours worked in the days preceding an injury.

The results showed a significant relationship between lengthy work hours and recordable injuries--for example, the risk of injury was 27% greater when an employee worked more than 64 hours in one seven-day week, and four times greater when an employee worked more than 16 consecutive hours in a single day. Based on these findings, Alcoa requires Contractor employees to:

Limit the number of consecutive hours worked in a single day to no more than 16. One must be off for at least 8 hours before returning to work.

Limit the total time worked in a payroll week to no more than 64 hours.

- 20. Alcoa will require the contractor to submit a detailed safety and rigging plan for all complicated lifts. (The minimum requirements will be for 2-crane lifts and lifts that exceed 75% of the rated capacity of the crane. Alcoa Engineer may require addition lift plans if complications are anticipated.)
- 21. Storage requirements must be provided for all items shipped to Warrick Operations. Alcoa will make every effort to store materials for this project but on-site storage is limited and the manufacturer may be required to store materials at their location for a period of time before shipping. The contractor shall schedule the arrival of materials to coincide with the



installation schedule to reduce the amount of material staged on the plant site. (This must be coordinated with the Construction Management company)

Contractor should contact Morton Avenue Warehouse (Mark Happe is the coordinator) if indoor and/or heated storage is required for any components that must be shipped prior to immediate installation. It shall be at the contractor's cost to rent the necessary storage space to store these materials until time for installation.

Contact information:

Mark Happe - Morton Avenue Warehouse Coordinator

Mobile: 812-470-6878

Email: markh@mortonavewarehouse.com

- 22. Shipping methods, the way each load is positioned on the truck, the type of truck used for delivery, the delivery dates, and rigging plans for unloading will be communicated through the Construction Management Company BEFORE any deliveries are made to Warrick Operations. The rigging plans will include rigging points and each load will include clearly labeled center of gravity for each container and communicated to the construction management company. Consideration for removal, such as cribbing and lifting should be planned before loading. Building access doors are 15'-7" wide x 15'-4" high. These dimensions can be increased by 2" to 6" if various components are removed. Contractor must verify these dimensions during field visit. Drawings can be provided if needed.
- 23. The contractor will be responsible for unloading, storage, and transportation of all materials associated with this portion of this project. Alcoa has a 4 ft. fall protection rule. This applies to unloading as well. Contractor to make provisions to comply with this rule!
- 24. Utilities provided by Alcoa are building lights, 480V welding receptacles, incidental compressed air (avg. 80 PSI), and potable water (several lines). Contractor will need to supply electrical control panels to step down the 480 volts to meet the needs of equipment. Standard 120 volt, single-phase outlets are not readily available on the plant floor and are typically fused at below 20 amps for the entire circuit. The location of these utilities will be discussed during the site visit meeting.
- 25. If awarded the contract, the contractor is responsible for making all prints from their digital copies.
- 26. The contractor will be responsible for all permanent and temporary employee badges.
- All contractor employees must have a Drug Test Card or go through screening prior to coming on site to work!
- 28. Final "For construction drawings" will be issued with a spreadsheet that itemizes the significant or dimensional changes from the bid set.
- 29. Alcoa reserves the right to inspect and monitor the intermediate progress of the fabrications at the suppliers' shop. Alcoa will inspect all fabrications in the suppliers shop before shipment unless the supplier is told otherwise by Alcoa's engineer or their designee. Alcoa will inspect all fabrications for workmanship, dimensional accuracy and fabrication tolerances for flatness, squareness, and straightness as appropriate or as indicated on the drawings.
- 30. All issues with the fabrication drawings shall be brought to the attention of Alcoa's engineer or their designee via an e-mail that includes the drawing number, item number, a description of the issue and a recommended solution if the supplier has one. The supplier shall get approval from Alcoa's engineer or their designee before proceeding with work that involves the issue.
- 31. This contractor shall coordinate the activities of all the craft people to provide a safe work environment and efficiently meet the schedule.



32. As will be described during the site visit, the construction area of CSM complex will be next to a busy production area with vehicular travel in close proximity of the work area. All safety rules regarding protection of workers from vehicles, protection of workers from molten metal, and protecting the Alcoa workers from the contractor's actions (including welding flash protection) must be enforced. Contractors will have to keep a minimum distance of 50' feet from any active production activity.

Mobilization and Demobilization

- 1. The contractor shall mobilize all equipment necessary for execution of this contract.
- 2. The contractor will be assigned an area for tools and construction equipment to be stored when not in use.
- The contactor shall demobilize his personnel and construction equipment off the job site after acceptance by the owner's representative that all the work has been completed. The construction site shall be left in a clean and orderly condition ready for operation of the furnace.

B.3 Project Management Requirements

- Seller shall have a single point of accountability (SPA) person for this EPCM contract. This
 person will be responsible for the total project schedule and milestones.
- Seller is responsible for meeting all milestones and schedule dates as agreed to in the
 contract. Any delays will cause work to be accelerated to catch up to schedule and shall be at
 the time and cost of the contractor. These shall not be considered as change orders or
 extras.
- 3. Seller is responsible for the entire contract installation being complete at the cost agreed to in this contract.
- 4. Seller is responsible for all communication and coordination of all project requirements to Alcoa and/or their assignee(s,) engineering subcontractors, construction subcontractors, and construction over site subcontractor for this project. Seller shall provide and maintain a daily project schedule, in MS Project format (or other formats approved by Alcoa Engineering), so all parties are aware of the work scheduled for each day and whether it was completed on time. This schedule must be updated and submitted to Alcoa on a weekly basis. Any erosion of schedule shall include documentation of reasons for the schedule delays and a "Recovery Schedule" will be submitted to show how contractor shall meet original contractual completion date. This will include a weekly project cost expenditure, cost to date against the project, and the forecasted expenditure for the next week.
- 5. Seller is responsible to communication and scheduling permit requirements, working with Alcoa production scheduling, and work safety reviews for all work on this project.
- Seller is responsible for maintaining the agreed to project schedule. Any changes, modifications, or delays to the schedule after the agreed to date shall be the EPCM contractor's responsibility for additional work and cost for such work to return project to the agreed to schedule.
- 7. Seller is responsible for providing critical design information and interface to Alcoa and subcontractors for design and installation of foundations, utilities building routing to contractor designated tie in point, and building modifications which are outside this contract scope of work. This communication process must include an approval process that includes "interface



drawings, descriptions, or calculations signed by the Seller, interface design firm, construction management firm, and Alcoa. Examples of this type of interface are:

- o Reaction loads for furnace and corresponding foundations design that include elevations.
- Anchor bolt layout and corresponding anchor bolt details with elevations, torque specifications, grout requirements, etc.
- o Takeover points including electrical power, natural gas, compressed air, etc.
- Duct design and corresponding duct supports.

This information shall be provided complete to Alcoa and subcontractors on an agreed to schedule. Any changes, modifications, omissions or deletions by the Seller after these dates, which cause additional work or rework by Alcoa subcontractors, shall be back charged to the Seller to bear the cost. Any delays in the Seller's schedule due to these changes shall be the Seller's responsibility to accelerate the work to return to schedule and bear the cost for such additional work.

- 8. Any changes requested by Alcoa will be considered for a Change Order Request. These changes should be proposed with the assumption the final completion date cannot be changed and work to be scheduled so delays are not incurred. This does not include any engineering, design, installation, construction, or equipment issues that are found by Alcoa or their representations that do not comply with the engineering, design, construction and safety standards referenced herein or standard accepted construction practices. Any and all such issues will be corrected by the Seller at his cost and with no delays to the agreed to schedule.
- Contractor is responsible for all safety training, reviews, JSA, construction safety practices and adhering to all referenced safety requirements, Alcoa Standards, and OSHA requirements. Contractor should estimate 1 day for each employee for Alcoa specific on-site training.

C. PROJECT SCOPE OF WORK FOR CSM FURNACE COMPLEX

C.1. Furnace Foundations

Furnace foundation design and installation will be provided by Buyer.

C.1.1 Sellers Requirements

Seller shall provide Buyer with foundation outline drawings and associated engineering calculations showing foundation loads needed to design foundations, all necessary anchor bolts, curbing, guard rails, etc. Foundation loads shall be considered for maximum furnace loaded condition. Seller shall provide preliminary information to Buyer to support overall project schedule.

Seller shall also consider thermal loading from operating furnace floor to Buyer foundation. Radiant heat or elevated ambient temperature information shall be forwarded to Buyer as part of the information package, such that appropriate design measures can be taken to ensure longevity of the foundation. Seller design should already take into account the need for proper air circulation in this area to minimize the impact on Buyer foundation.

Seller is responsible for designing & routing all embedded utilities from Take-Over points. This information must be provided to the Engineering firm designing the foundations at the same time the foundation loading requirements are provided. (Embeds shall include a minimum of 10% "spares" such as additional empty conduits and additional embedded gas or air lines.)

C.2. Furnace Mechanical



C.2.1 Furnace Capacity & Operation

Gross capacity shall be calculated and provided to Alcoa based on a molten metal density of 148.27 lbs per cubic foot. Capacity will be sized to melt aluminum scrap for an annual output of 180 M lb. /yr. based upon:

- o 330 days/yr. operation
- o 85% availability
- o Ability to remove 60,000 lb. of aluminum from the furnace in a 20 minute timeframe.

Furnace will be a continually charged with up to 30,000lbs/hr, recycled aluminum. The molten metal circulation and chip ingestion system will be the proprietary Buyers Vortex bowl. Drawings and manufacturing resource will be disclosed after NDA has been signed.

Realized production melt rate of primary aluminum to 1460 degrees F shall be 30,000 lbs/hr. Fuel rate is discussed in Section 4 of this specification. The furnace shall maintain temperature of molten metal, as measured by the bath thermocouple, to nominal set points ranging between 1400 and 1460 degrees F. These values will be verified and confirmed during field tests as described in Section 10 of this specification.

C.3. Furnace Frame

C.3.1. General Structure

Structural shapes shall be standard available AISC shapes. Welding shall conform to American Welding Society's "Code for Arc and Gas Welding", to AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings", latest revision and "The AWS Structural Code" of the American Welding Society AWS D1.1-72, latest edition. Furnace fabrication shall conform to Alcoa Specification 26.9 "Fabricating Components for Molten Metal and Processing Furnaces", revised December 2009. Furnace side walls shall be a minimum of 3/8" and floor panel shall be a minimum of 5/8" steel plate.

Furnace structure shall be rigidly designed so that the frame and all other parts of the furnace will not deflect or incur damage in the event the fully insulated furnace is full of metal.

The "hot face" of the furnace shell, shall be seal welded in all areas below metal line.

Furnace structural design shall be such that the potential to overheat furnace components and surrounding equipment and foundations is minimized. Proper spacing of components away from known hot spots and allowance for natural air circulation around the furnace shell is required.

Any penetration in the furnace shell shall have the perimeter of that opening reinforced with additional structural members. Stresses present in that section of the furnace shell will dictate the type of reinforcement required. Vendor must have approval drawings signed by Alcoa Engineering of all reinforcement plans for all penetrations before proceeding to fabrication.

Furnace shell shall incorporate weep holes. (Size, quantity, & location to be approved by Alcoa Engineering)

Rectangular tube steel is preferred for floor beams (Substitutions must be approved by Alcoa Engineering)

The preferred orientation of standard furnace wall plates is for them to be installed horizontally. Alternative construction methods must be approved by Alcoa Engineering.



Furnace shall be designed such that fabricated sections can be transported over public roads and highways from fabrication site to installation site. Furnace shall also be designed such that fabricated sections of the furnace shell (floor, all sides, roof, flue, etc.) can be lifted, fitted, and permanently welded together as an assembly at Buyer's facility. Lifting connections shall be clearly identified on both equipment and Seller drawings, and interconnecting hardware shall be provided where applicable.

Vertical clearance from the floor to the high bay roof is approximately 50' to the Decking and roughly 39' to the bottom of the trusses (29 ft. to the bottom of the overhead crane girder). Building steel drawings will be made available to Seller after placement of purchase order to confirm equipment placement and installation envelope.

Any shims required for furnace installation shall be clearly called out on Seller's drawings and bill of materials. Deburred shims are to be supplied by the installation contractor, of adequate size and varying, uniform thickness to ensure proper weight distribution of furnace loads to foundation.

All components and sub-assemblies that will be handled during furnace construction or maintenance of the equipment shall be designed to have lifting eyes, rings, loops, etc. to facilitate lifting with chains or slings.

Removable safety guarding in accordance with OSHA standards shall be provided where required and as agreed in design review with Buyer prior to design completion.

C.3.2. Charge Bay & Melt Bay Common Wall

If the melt bay and charge bay are designed to share a common steel wall with separate refractory cast walls, then this wall shall be air cooled with an independent blower, which feeds underneath the hearth of the melt bay and then up the common wall. This blower shall be used to cool both the hearth and the common wall.

C.4. Molten Metal Circulation System

C.4.1. Manufacturer shall provide their standard Molten Metal Recirculation System as part of the base price.

C.4.2. **OPTION** – Alcoa Vortex System (Price separately in Attachment B) - The pumping system for the furnace to move metal from the melt bay to the charge bay and ingest the recycled scrap will be located on the north wall of the furnace and incorporate a proprietary Alcoa designed vortex bowl and recirculation molten metal pump. Seller shall design the system to circulate molten metal and ingest scrap into the vortex bowl. Alcoa prefers the Vortex System be on the back side of the furnace! (See Alcoa drawing A-194174-WK for a typical circulating pump assembly). Alcoa will provide the Vortex System ceramic shapes to the contractor. Alcoa will provide vortex size; hopper size, scale to use, and conveyor requirements! Vortex System generic drawings can be provided after the Contractor has been chosen and has signed an NDA. Alternatives require approval by Alcoa Engineering.

The vortex will have an ingestion rate of 30,000 lbs/hr. The operating range of the vortex system is 6".] There is a potential to operate the metal at a higher level, but this would negatively impact the ingestion rate of the vortex system. This can be discussed with Alcoa Engineering during the design phase if the additional furnace volume required to stay within the 6" range significantly impacts cost or operating characteristics of the furnace design. NOTE: The minimum height from top of the hearth to the bottom of impeller is ~16" this does not include the normal sloping of ~3" to decrease sludge entering the cance! The seller and buyer will work together for the design of this area as we are using the Alcoa vortex



bowl. The design should avoid direct metal flow impingement on ramps as this will erode material rapidly. This part of the design should also include electric jib hoist for maintenance access of the pump and vortex. Conductivity probes shall be place over the vortex bowl to be integrated as a safety shut off if level reaches the probes. Alcoa will clarify specific equipment to use.

There shall be a platform that is accessible via stairs to access the molten metal & circulating pumps and vortex for regular operational and maintenance practices. The platform will include ample room for pump & conveyor control panels, tool storage, ample room to change pumps and clean the vortex bowl. The ability to change and access the pumps will be included. Safety barriers to protect operators from contact with molten aluminum caused by pump splashing and pump riser leaks will be included in this design.

C.4.3 Option - Zmag Canal Stirring System - HAS BEEN DELETED.

C.5. Molten Metal Transfer System

Furnace shall have one tapping pump well located on the north wall with access from the east side of the furnace. The pump shall be capable of conveying 10,000 lbs of metal in 2:00 minutes to the necessary 'head height." Seller shall design the system to pump molten metal out of the furnace into an open-top crucible that rests on the ground. The exit end of the discharge trough shall have a minimum of 7'-0" clearance above grade to enable the open top crucible to be placed under the trough by Warrick's Cruce Haulers. (See Alcoa drawing A-193159-WK for a typical tapping pump arrangement on No.10 RSI furnace complex.) There will be a second installed spare pump located in the tapping well. The transfer system shall be designed with redundant pumping systems, such that when the primary pump fails, the secondary pump can immediately be used to fill the crucible with molten metal while the primary pump is being replaced. Alcoa prefers the below pumps to be used for consistency and spare parts consolidation. Alternatives require approval by Alcoa Engineering.

<u>Primary Pump</u> – Pyrotek Tensor Series T35 Transfer Pump. We use two sizes at Warrick. A "standard" size and a "16 inches taller than standard" size. The difference depends on the elevation change required for discharge height. (Data Sheet is available upon request.)

Two (2) completely assembled spares w/ stands are required.

<u>Backup Pump</u> –Pyrotek Overflow Transfer System pump. (Data Sheet is available upon request.)

One (1) completely assembled spare w/ stand is required.

Alcoa requires a tapping well drain be installed. The drain will be located based on the low point in the furnace, and an available location for a cruce pit that has overhead crane access. The drain will incorporate the standard Alcoa drain block and pneumatic plugger. (Prints can be provided upon request.)

C.6. Furnace Sill & Skim Shelf Elevation

The elevations of furnace sills and skim shelves shall be determined by furnace design and shall account for the physical limitations of the furnace Charging/Combination machines that will be purchased by Alcoa. The machines will be Glama MCM AWS. (Specifications can be provided upon request.)



The front edge of the skim ledge shall be sufficiently strong to maintain shape and refractory integrity with exposure to elevated temperature and constant mechanical abuse during charging and skimming operations. Front steel skim shelf plate shall be a minimum of 1.5" thick.

Sill steel and refractory design should allow for periodic replacement, in order to sustain proper furnace door seal.

C.7. Melt Bay Door & Charge Bay Door

One non-water cooled door and door opening with heat resistant, maintainable contact surfaces around the opening shall be provided for each chamber of the furnace. Contact surfaces for door seal to furnace shall be selected for continuous duty service at maximum operating temperature, and shall be easily replaceable.

Door should be a top lift design with heavy duty side chains to pull door in against the face of the furnace when lowered. There should be adjustable turnbuckles on each side to adjust the pull in chains. Door will have an adjustable fiber perimeter seal, approx. 8" wide and 12" thick to be adjusted with jack bolts. The center of the core of the door will be a light weight castable. Stainless fiber reinforced refractory jambs and lintels are required and act as the sealing surface for the door. A heavy duty high alloy steel sill cover plate shall be installed as the lower sealing surface. An angled plate shall be attached to the lower part of the sill plate to direct skim into the dross bins. Door lift system will consist of a heavy duty motor gearbox driving to large sprockets for the chain lift. Chain will incorporate an easily adjustable tension sprocket. Gearbox will be of design that will not backdrive. Door lift system will incorporate an adjustable clutch and an electric brakemotor.

Door and refractory lintels shall be protected by replaceable mill duty headache bar, mounted at lintel elevation, with space to allow door to pass behind, but extending no more than 32" out from face of door opening to allow for Buyer furnace tending equipment.

Door open/close operation is to use mechanical lift. Drive unit shall be mounted in accessible location sufficiently away from exposure to elevated temperatures.

Door shall have redundant position switches properly located away from the heat. When "Door Closed" switch is NOT made, furnace burners are forced to low fire condition for lighting and/or charging operations.

C.8. Access to Furnace Roof and Pump Wells

- C.8.1. Seller shall design systems such that they can be easily accessed for maintenance purposes. Below are examples of systems that will likely require thoughtful design for access platforms:
 - a. Combustion components (Especially on the individual burners)
 - b. Access to furnace roofs and elevated work surfaces (Stairs are preferred but ladders are acceptable after approval by Alcoa Engineering)
 - c. Pump wells and vortex shall have large platforms surrounding equipment and include room for Alcoa standard skim pan (Alcoa drawing A-186545-WK) and access for fork truck to install/remove the pan from the platform.
- C.8.2. Removable banded grating shall cover entire roof to provide safe and easy access to all operating components. From the melt bay roof platform, there shall be access to the charge bay



roof, any change of elevation shall have stair transitions whenever possible. Engineered tie-off points shall be included to enable a minimum of 4 people to work on the roof using retractables while the roof grating is removed.

C.8:3. Rigid hand rails with toe plates meeting OSHA/Warrick standards shall be provided around the top of the furnace.

C.8.4 There shall be adequate platform access to all major burner components when not accessible from ground level.

C.9. Flue & Exhaust Duct

Furnace exhaust products will leave the furnace chamber through a Seller designed exhaust system. Hot exhaust gases will turn up into refractory lined flue. Flue and exhaust ductwork shall be designed to handle exhaust products resulting from seller designed combustion system. Duct should be sized to remain below 30" water column suction pressure.

Flue shall be equipped with means of controlling furnace pressure at the furnace sill to approximately ± 0.025 , water column, a 1-1/2" NPT sampling port (used by Buyer for combustion tuning), and a flue thermocouple and well. Thermocouple shall be located such that it is not affected by radiated heat from the molten bath. Seller shall supply a mechanical damper that is Beck driven.

C.10, Exhaust Stack

Flue gas leaving exhaust duct described above will be directed into a Seller designed exhaust stack. Seller shall properly size the stack to provide negative pressure to ensure adequate furnace pressure control for the full range of operating flow and temperature from the furnace. Actual flow and temperature will be determined by choice of combustion operations options as described in Section 4 of this specification.

All ductwork and related components within reach of personnel shall be insulated to 140 degree F maximum skin temperature, or labeled and guarded if this is not practical.

Exhaust stack shall be supported as necessary from the floor and the building structure. The Exhaust stack shall maintain a minimum of 2 feet clearance to the five (5) overhead cranes that operate in the bay of this building. The exhaust stack must route between the crane columns along either B or C-column line. The roof penetrations will be designed and provided by Seller. Alcoa can provide approved local contractors at contractor requests.

All collection hood supports, duct supports, etc. shall be designed by an Alcoa outside engineering firm familiar with the Alcoa building structure!

Seller shall provide the following information to the Buyer Engineers within 8 weeks of the purchase order award:

- Exhaust system and stack design concept
- Related design flow and temperature information shall be provided to Buyer engineers within 2 weeks of purchase order award.
- Stack design and roof penetration details.

Any portion of this exhaust system not included in Seller scope of supply shall be specifically excluded and/or clarified in Seller quotation.



The Exhaust stack shall discharge sufficiently above roof line to conform to state & local codes and industry best practice regarding dilution, strength for wind load, etc. (The height will most likely be 1.5x the height of the closest building structure.) The furnace manufacturer must provide Alcoa EH&S the emission factors as soon as possible to enable Alcoa EH&S determine the required stack height and to file for a permit with IDEM.

Contractor is responsible for all roof and structural penetrations. Alcoa can provide approved local roofing contractors at contractor request!

NOTE: If the manufacturer is NOT able to guarantee that the metal in the "melting bay" portion of the furnace will meet Indiana's definition of "clean metal" then the fumes from the "melting bay" must be treated by the Seller provided baghouse.

C.11. Inlet Stack Assembly

The inlet of the primary combustion air blower shall be designed such that it pulls in fresh air from outside of building 134. (Additional blowers should consider using the same fresh air inlet if economically feasible.)

C.12. Refractory

Seller shall utilize Alcoa-approved refractory materials and hardware wherever possible in the design and construction of this equipment. Related Alcoa specifications controlling the supply and installation of related materials are also included at the end of this document in Alcoa Refractory Installation Standards. All materials proposed in this design shall be reviewed and approved by Buyer engineers before they can be purchased and utilized on this equipment. Alcoa has agreements with the refractory companies specified to have an on-site representative present to assist and supervise their refractory installation at no cost to the contractor. Alcoa expects the contractor to use the appropriate representative for all installations! All metal contact refractory shall be casted and not pumped.

Seller shall forward the following preliminary information to Buyer engineer for consideration and approval:

- Complete drawing package illustrating proposed refractory installation of all furnace surfaces. All material layers will be identified corresponding to bill of materials. All material layers will be dimensioned for thickness. Refractory anchors are to be indicated.
- Complete bill of materials to indicate all refractory and support components utilized in the design, including original manufacturer part numbers and quantities required in the design.
- Material Data sheets for all refractory materials utilized in the design, with material composition, hot and cold strength data, installation, and dry-out information (as required).
- Heat transfer calculations for each surface and layer composition. Calculations shall be based upon maximum 1500 degree F for metal contact areas, and maximum 2150°F for above metal contact areas. Interface temperatures at all layers of construction shall be included. Maximum furnace steel shell temperature shall not exceed 250°F average hearth and 200°F average wall. Metal freeze plane shall be indicated as in working layers.
- Confirmed dry-out schedule governing the necessary setpoints, ramps, and hold times necessary to drive moisture from the thickest portions of the refractory installation.
- Buyer and seller to inspect refractory annually.



C.12.1. Side Walls

Upper side wall refractory shall utilize appropriate materials for non-metal contact service temperatures to maximum 2150°F, with additional consideration for refractory near burner flame and flue transition, and repeated mechanical abuse from charging prime ingot and scraping/stirring operations. Lower wall material should extend 18" above metal line.

- Lower Walls: Allied Minerals, 85ACX
- Upper Walls: Harbison Walker Versatech 55 AR HS Plus
- Alcoa standard insulation materials shall be used including 2" Thermal Ceramics Superwool 607 board for metal contact; 2" TR19 and 2" Fibrex 1900 for upper wall areas.

Sufficient refractory footer of appropriate material shall be provided to support side wall installations. Tap hole refractory shall be sufficiently sealed to prevent leaks, able to be cleaned, and maintainable should issues occur.

Areas in lower walls deemed necessary to cast or ram in place shall be appropriately keyed and anchored, with appropriate selected material for upper wall or lower wall applications. Areas near door jamb not pre-cast but exposed to cycling thermal stress shall be keyed and anchored.

Provisions shall be made in side wall linings for tap hole block, drain hole block, pressure port, bath thermocouple block, burners, and flue, with appropriate consideration to operating temperatures, thermal cycling, erosion, and maintainability. Weep holes/wicking ropes (1/4" size) shall be places in lower wall on 24" centers.

C.12.2. Floor

Refractory in the floor shall consist of appropriate hearth, insulating sub-hearth, and backup insulation materials, considering impact loading, thermal cycling, and longevity. Floor shall be sloped 1-1/2" over 10' toward pump well and drain hole to ensure proper drainage of furnace to dry hearth during shutdown. (If this furnace will require a drain block, the same slope shall be designed for it.) Joints between sub-hearth layers and side wall shall be keyed together. Steel sub-plate shall be drilled with vent holes to support furnace dry-out. Weep holes/wicking ropes (1/4" size) shall be places in hearth and brought out to the side walls on 24" centers.

Refractory shall be as follows:

- Melt Bay Hearth: Allied Mineral 85ACX
- Charge Bay Hearth: Allied Mineral 85ACX
- Sub-hearth: Vesuvius Alugard H&B
- Sub-hearth insulation HW Greenlite 45AL

C.12.3. Roof

Roof castable installation shall be minimum 12" layer on hot face with 3" layer of insulating roof castable on cold face. Expansion joints shall be provided for expansion in all directions. All joints shall be keyed.

Internal roof elevation shall be approximately 12" above the top of the front door opening and shall provide for the necessary volume for combustion as well as for easy access for skimming, stirring and charging with Buyer's equipment.

For cast-in-place roof installations, a minimum of one 12" layer of Harbison Walker Versatech 55 AR HS Plus castable with one 3" of Vesuvius Litewate 20/35 insulating roof castable shall be used in the roof. Expansion joints shall be provided for expansion in all directions. Roof shall be



divided into sections using aluminum divider that will act as an expansion joint. The refractory anchor system for the roof shall consist of anchor brick (Snowshoe) only, WP-85 roof anchors, 3" S-beams, and R-42 beam clamps.

C.12.4. Flue

The flue will be sufficiently sized to evacuate the highest temperature products of combustion from the furnace with moderate velocity affecting exhaust system pressure drop and detrimental refractory erosion. The flue shall be lined with appropriate upper wall refractory to withstand elevated continuous 2300°F exposure, with backup insulation materials. The Flue hood and air damper should also be insulated if needed to withstand continuous elevated temperatures (1000°F)

C.12.5. Ramp, Sill & Ledge

Ramp, sill, and ledge are located inside the door on the west side of the furnace. After a small sill for skimming furnace, Twenty Seven (27) degree (6 rise to 12 run) ramp transitions down to floor (hearth) refractory.

Ramp shall be sufficiently designed to withstand repeated charging of prime ingot as described in this specification, skimming/scraping/stirring operations, exposure to high fire flame temperatures (not impingement), and continually variable molten metal bath elevations.

For castable installations,

- Melt Bay Ramp: Vesuvius Alugard RHB
- Melt Bay Sill: Vesuvius Alugard RHB
- Charge Bay Ramp: Vesuvius Alugard RHB
- Charge Bay Sill: Vesuvius Alugard RHB

Sill area inside door opening shall be sufficient to withstand thermal cycling and repeated abuse. Seller shall propose to buyer design concepts that this portion of the furnace refractory installation is removable for infrequent maintenance to sustain both sill and door seal quality. Sill shall be sufficient to pull skim and drain metal back to bath before removing from the furnace. Final dimensions of sill and ledge shall be reviewed with Buyer engineer prior to design completion and material purchase.

C.12.6. Door and Jambs

Door will have an adjustable fiber perimeter seal, approx. 8" wide and 12" thick to be adjusted with jack bolts. The center of the core of the door will be a light weight castable. Stainless fiber reinforced refractory jambs and lintels are required and act as the sealing surface for the door. A heavy duty high alloy steel sill cover plate shall be installed as the lower sealing surface.

-Jamb & Lintel: Allied Mineral Armormax 70 SR

C.12.7. Dry Hearth

Dry Hearth: Vesuvius Alugard RHB

C.13. Pressure Port

A pressure port shall be located near the door (away from the flue) in the furnace with sufficient relief on the hot chamber side so that it will not plug. The pressure port shall be in a position where it can be easily inspected and cleaned from the outside of the furnace. The pressure port



shall be designed, located and installed to assure that a positive average pressure of 0.025", WC at the sill can be maintained at steady state.

C.14. Piping

- C.14.1. Seller shall furnish as much of the furnace piping as practical in pre-piped and preassembled form such that it can be easily transported and installed. Seller shall include piping layout drawings with detailed bills of materials (including components, fittings, supports, etc.) for combustion, pneumatic, and utility piping.
- C.14.2. The arrangement of all pipes shall be as straight and direct as possible, at right angles and parallel lines. All piping equipment, accessories, etc. shall be securely supported as near to the furnace frame as is practical. Piping shall be routed to avoid areas where Operators must perform routine tasks and shall take into consideration maintainability.
- C.14.3. Utility piping shall consist of schedule 40 supply lines: Compressed air is designed for 80 psi nominal pressure. Provide 4" pipe for compressed air supply to furnace and 1" pipe for compressed air drops. The natural gas will be supplied at 35 psi. Provide a 2" pipe for the natural gas header to the furnace and $\frac{3}{4}$ " pipe for drops. Piping larger than 2" shall be welded and sets of flanges shall be installed frequently for future maintenance. Piping 2" and under shall use threaded fittings. Swagelok fittings shall be used on all tubing connections. All natural gas lines shall be securely fastened to support structures.
- C.14.4. All piping shall be installed to a Take-Over point in existing line at buyers designated location. The Take-Over points will most likely be located along building column lines B or C. within 5 ft. of ground elevation.
- C.14.5. ALL FRL's located in compressed air systems shall have redundant/bypass systems installed such that filters & oilers can be serviced without disrupting flow to downstream equipment.
- C.14.6. Include 1" Auxiliary Air Drops by the pump wells, vortex system, top of furnace, and one on each side not already covered (Fittings shall be Dixon Model 4P, Steel Thor Quick Coupler
- C.14.7. Include 3/4" Auxiliary Gas Drops by the pump wells and vortex system. Each gas drop will include a Reelcraft model 4625 OLP retractable hose reel, 25ft of AERO-FC321-06RL natural gas hose, with the hose terminating with a Swagelock B-QC6-B-4PF fitting.
- C.14.8. Include Auxiliary Nitrogen Drops by the pump wells, vortex system, and gas train (Fittings shall be Snaptite VHC8-8F Quick Coupler Body)
- C.14.9. The main natural gas feed to the furnace shall have a plug valve installed immediately after branching from the main gas header in the building rafters. (Resun R1431 flanged plug valves w/ lockable handles are preferred)
- C.14.10. All natural gas shutoff valves that are 2" diameter or larger shall be flanged plug valves. (Resun R1431 flanged plug valves w/ lockable handles are preferred)
- C.14.11. All natural gas shutoff valves that are less than 2" diameter shall be Apollo Series 90 UL Listed ball valves (No butterfly valves will be accepted in the gas systems)
- C.14.12 Lock, Tag, Verify (LTV)



CSM Vendor shall insure that the design makes provisions for energy isolation devices for LTV. This includes lockable handles on all valves that can be used for LTV & local electrical disconnect switches for all equipment. This includes but is not limited to:

- An in-line blank device shall be incorporated into the gas train for the "Primary Shut-off Valve" (Such as a spectacle blind flange). A second valve shall be located immediately downstream of the Primary Shut-off Valve with a test port in between the two valves. This will enable Alcoa "Leak Check" the Primary Shut-off valve.
- 2. The "Primary LTV Valve" on each piping system shall be designed to meet the requirements for "double block and bleed capability"
- 3. All gas valves shall be lockable for LTV
- 4. All air valves shall be lockable for LTV
- 5. All nitrogen valves shall be lockable for LTV
- 6. All hydraulic valves (if applicable) shall be lockable for LTV
- 7. The cooling air for the Flame Detector and the combustion air for the burner pilot shall have separate lockable LTV valves.
- 8. All LTV valves that will be used for lock out purposes shall be positioned for easy access by personnel.

C.15. Cleaning & Painting

All painting shall be in accordance with Engineering Standards 33.218.2 and 33.218.8.

Furnace Steel:

Furnace steel provided by Seller shall receive a hand tool cleaning in accordance with the Steel Structures Painting Council (SSPC) Specification SP2-63. One coat of high temperature aluminum, rated for maximum surface temperature, shall be applied before shipment. Following erection, base area and new welds shall be touched up by installer with matching paint. System 17 (SZ/HT4) shall be used for the painting of the furnace shell.

Combustion System:

Special care must be taken to ensure all manufacturers' name and data plates are not rendered illegible. Combustion air ductwork shall receive a commercial blast cleaning per SSPC Specification SP6-63, one coat of zinc phosphate catalyzed epoxy primer, followed by an epoxy intermediate coat. Use V7 System.

Equipment Guards:

All equipment guards such as shaft and coupling guards shall be coated with epoxy yellow finish coat after being prepared as described above. Use V7 System.

Pedestrian/Vehicle/Equipment interface guarding shall be 10" square x 3/8" wall thickness (minimum) structural steel tube embedded a min of 3 ft. or with removable sections where needed for maintenance!

Furnace Stack:

Furnace stack components supplied by Seller shall receive a near white blast cleaning in accordance with SSPC-SP10-63t, followed by 2 coats of high temperature aluminum paint. System 17 (SZ/HT4) shall be used for the painting of the furnace stack.

C.16. Lubrication



All parts requiring grease lubrication shall be initially lubricated with grease of an NLGI No. 2 consistency and tagged prior to shipment (such as Gulf Crown grease NO.2). Single grease points shall be equipped with easily accessible Alemite button head type fittings. Prior to shipment, all exposed machined surfaces shall be coated with a light coat of machine oil to prevent rust in transit to installation site. Seller shall furnish complete lubrication specifications for all components and devices supplied by Seller to Buyer's engineer at time of shipment of components and devices requiring lubrication. Refer to section 5.9 of Engineering Standard 30.17.

C.17. Thermocouples

C.17.1. Bath Thermocouples

- 1. Bath T/C: The furnace operator will choose when T/C system shall be inserted into the furnace. Pushbutton station near T/C plug-in shall signal to the main controls that pyod has been inserted and furnace is OK to transition from flue control to bath control. The inserted T/C "pyod" will consist of one (1) K-type thermocouple to monitor temperature in the bath Thermocouple shall be a retractable tube type side wall mounted connection in the Melt Bay with a removable flange connection. Bath T/C shall be in the circulation path of molten metal and approximately 6" below centerline of typical bath level. The pyod opening hole size and its location shall be such that it is not subjected to direct flame, is easily accessible for maintenance, avoid metal freezing, and facilitate clean up in the case of metal/sludge build up. Pyod insertion system concepts shall be capable of measuring temperatures at adjustable depth locations within the bath! Overall design shall be approved by Buyer prior to performing fabrication.
- 2. <u>Circulation System T/C:</u> This shall be a type K thermocouple located in the "Circulation Channel" that is located externally to the furnace shell. Location and design shall be reviewed and approved by Buyer's engineer prior to completing detailed drawing. Overall design shall be approved by Buyer prior to performing fabrication. This T/C shall be located in a Sialon protection tube.
- 3. Tap Well T/C: This shall be a type K thermocouple located in the Tap Well. This T/C shall be located in a Sialon protection tube.
- 4. Toilet Bowl Overflow T/C: This shall be a Type K thermocouple (Bare, with no protection tube) placed near the top of the toilet bowl on an adjustable fixture that can be set to a level which will alarm potential overflow condition, and shut down pumps.

C.17.2. Flue Thermocouples

Thermocouples used to measure temperature of hot combustion products over 2100 degrees F shall be type S thermocouple assembly with double ceramic protector tubes located in the flue or the furnace roof. Preference is to avoid thermocouples in the furnace roof. Function of the thermocouples will depend upon approved combustion and high limit temperature control method. One thermocouple will be used for control and the other is to be hard wired for overtemp.

C.17.3. Refractory Thermocouples

Type K thermocouples will be inserted into the refractory inside stainless steel tubing for long-term monitoring of the hearth temperatures at the steel shell interface. The spacing of these T/C's shall not exceed 10 feet in the hearth. At least 2 T/C's will be installed in this



manner for each wall. The wires for these T/C's shall be routed to the "Pyro Panel" & landed on a terminal strip such that they can easily be changed for future refractory relines. Seller shall configure these T/C's so that the signals can be continuously transmitted to Alcoa's Citect system. (Alcoa will be responsible for the programming once the signal reaches the Citect system.)

A thermocouple well shall be installed in the sidewall of the Charge Bay so that a T/C in a protection tube can be inserted to monitor the temperature of the bath in the Charge Bay as well as to monitor temperatures during refractory dryout. The location shall be approved by the Alcoa engineer. Thermocouple well shall be Alcoa Standard drawing A-186129-WK, items 5 and 6.

C.17.4 Dry-out Thermocouples (temporary - for dry-out only) DELETED

C.18. Scrap Charging/Combination Machine

C.18.1. DELETED

- C.18.2. Alcoa will supply a GLAMA MCM AWS combination charging machine for this application. Seller must verify the furnace is designed such that this equipment can adequately access the furnace for charging and tending operations. If there are any concerns with the capabilities of the Glama such as maneuverability, reach, height, etc., the Seller is responsible to bring that information to the attention of Alcoa before detailed design of the furnace begins so that this can be discussed and corrected.
- C.18.3. Seller shall recommend a sufficient number of "charge tubs" to enable Warrick to build charges ahead of time so that the furnace is efficiently operated. The number of charge tubs will be determined based upon cycle time of furnace charges and anticipated metal movement parameters.

C.19. OPTION: Uncoated Feed Conveyor (Price separately in Attachment B)

- C.19.1. The CSM vendor will include a system to ingest dry scrap into the Vortex System at a rate of 10,000 lb./hr. Hopper shall be capable of holding 15,000 lb.
- C.19.2. The metal units that will be transported and feed charged into the furnace by this system will be:
 - Loose scalps
 - Loose chips from the finishing line side trim
 - Class 1 Briquettes Approximately 12" cube (Max size is 30" x 16" x 16")
 - Loose can lids
 - Loose tab slugs
 - Auto Shred
- C.19.3. This conveyor system should be able to transfer material to the furnace from the floor. The conveyor will sit on a foundation that will be designed and installed for this project by owner selected contractor.

The floor fed conveyor shall include a hopper with the capacity to hold 15,000 lb. that will be charged with a front-end loader. The conveyor will be designed to minimize risk of damage to both the loader and conveyor during the loading process. The floor feed conveyor shall be capable of supplying the vortex system at a rate of 10,000 lb. /hr. This



will not be the primary feed system for this furnace, but will be used at time when this type of scrap is readily available and other forms of scrap are not.

- C.19.4. The UFS design shall be capable of a constant feed rate when using a "rolling 3 minute" average" and shall not vary by more than 20% from target.
- C.19.5. The conveyor system will include a means to continuously weigh the product being delivered to the furnace and a mean to easily calibrate the scales. (Such as Hardy C2 system, complete with load cells, controller, and analog outputs.)
- C.19.6. Design shall attempt to minimize Human/Machine interface to minimize possible personal injury from mobile or automated equipment. (Minimize "Worker on Foot" interactions)
- C.19.7. The conveyor system will include continuous monitoring equipment such as Carrier's Vibratrac, if vibrating conveyors are proposed.

C.20 Combustion

Seller shall supply complete combustion system required to melt given prime charge within insulated furnace as described at a rate of 30,000 pounds per hour using a direct-fired cold air natural gas heating system, based upon the average heat content of Alcoa natural gas of approximately 1,020 BTU per cubic foot. The combustion system shall be designed for plant floor elevation of 396'-0".

ALTERNATE: Contractor may bid an alternate regenerative gas burner but must provide reasoning to do so and economic evaluation of its benefit and performance.

The gas train shall be located at floor elevation and not on top of furnace.

All natural gas purge valves shall be piped to a vent line that routes the purged gases outside of the building. (Discharge point & routing to be approved by Alcoa Engineering)

A 1" nitrogen line shall be located within 10 ft. of the gas train that will be used to purge the combustion system gas train. The nitrogen line shall incorporate a pressure regulator that is correctly sized for the components present in the gas train.

Adequate cooling and/or heat shielding shall be included for all components exposed to heat from furnace components.

All pressure transmitters shall have local readouts. (Rosemounts are preferred)

All pressure transmitters to include drip legs with a valve to enable condensation to be drained from the "sensing line."

A Pilot Adjust (Pilot Test) Station shall be located within 10 ft. of each Pilot Assembly.

Individual Control Valves shall be used for each burner to control the Air/Fuel Ratio. (A separate gas & separate air valve for EVERY burner.)

The Overtemperature Relay shall have a 4-20mA signal output to the PLC to monitor the Overtemperature Thermocouple.

The Emergency Shutoff Down station shall be in an easily accessible location. (This location to be approved by Alcoa Engineering)

Test port / purge locations shall be included at below locations:



- a. Before and after each Maxon at each burner
- b. After the main lockout valve on gas train (Minimum 1" diameter)
- c. Before and after each gas train Maxon valve
- d. Before and after each pilot blocking valve at each burner
- e. Before and after the main pilot blocking on gas train
- f. Between the pilot gas mixing valve and the pilot

Furnace electrical system and wiring shall comply with latest NEC standards. Furnace combustion system shall comply with latest NFPA Standard 86 requirements, further controlled by Alcoa Engineering Standard 26.19, including required Alcoa Approved third party approval of system design documentation. Seller shall fill out application forms and provide all documentation as defined by the specification. Formal and final request to Alcoa Approved third party approver will be Buyer's responsibility. Gas distribution system shall be in accordance with NFPA 54 "National Fuel Gas Code", 2012 Edition.

Combustion and electrical control schematics (including PLC logic) with complete bills of materials shall be provided for review and approval prior to design completion and component purchase. Complete purchasing information and component sizing (flows, pressure, pressure drops for full range or states of control) shall also be included. Unless otherwise specified in this document, Seller selection (make/model) of combustion components shall be disclosed while bidding the project, for review and modification as needed by Buyer engineers.

Means to verify flow and pressure of both combustion air and gas through the combustion system burners as well as proof of combustion air immediately downstream of blower shall be provided, as well as a means to measure both primary combustion and regenerative efficiency.

Pressure taps shall be centrally located and easily accessible from either mill floor around the furnace or from the grating on top of the furnace. There shall be pressure taps downstream from all pressure regulators so that pressure from that regulator may be monitored.

C.21. Combustion Electrics

There shall be redundant wiring on critical outputs to prevent PLC output failure from keeping an output energized when logic determines that it should be off.

Critical outputs (such as the latch valve) shall be controlled by two outputs located on two different output cards to provide fail-safe operation. These outputs shall be programmed to operate together and shall be wired so that if one output fails then the output will not be energized. If possible, external feedback should be used to determine if an output failure has occurred and communicate this information to the operator.

An example of this type of control (fail safe with problem detection) which shall be used on the latch valve is given below.

Output 1 shall connect to the latch valve solenoid. Output 2 shall connect to a relay which has a normally open contact wired in series with output 1. Output 1 shall be programmed to control a timer which will control output 2. The delay is needed to permit problem detection and shall not be used on outputs which don't have problem detection. If output 1 fails in the "on" mode the latch valve will still be de-energized because output 2 will de-energize the relay coil which will open the relay contact wired in series with output 1. This will provide a fail safe operation of the latch valve.



The limit switches inside the latch valve shall be used to indicate what position the valve is in. If the limit switches indicate a different position than output 1 is requesting (after a brief delay to allow the valve to respond) then the operator shall be notified of this situation in a manner to be decided by future discussion with Buyer's Engineer.

C.22. Flame Safety

Continuously self-checking flame detection shall be provided with proper startup check to discern difference between fault in flame detection controls and actual flame ignition failure.

Flame safety relays shall be hard wired in series with main latch valve. A bypass contact shall be provided to permit latch valve to be opened when burner is off for light-up sequence.

Flame safety relays shall be self-checking type Honeywell solid state RM7895 and Q7800 Subbase with R7861A Signal Amplifier and C7061 self-checking detection head. Flame safety detector wiring shall be in separate, dedicated conduits and be hardwired to gas latch valve circuit. The RM7895 and Q7800 Subbase are to be located inside main furnace operators control panel. A Keyboard Display Module (S7800A1001) for each Flame Safety Relay shall be installed on the face of the control panel and protected by a NEMA 4 Cover with Reset Pushbutton (204718C). Use extension cable 221818 A (60") or 221818C (120") to connect the Flame Safety Relay with the Keyboard Display Module.

The following wire guidelines shall be used with the Honeywell RM7895 flame relay base.

Outputs from terminal 8 and 9 shall go to hardwired relays. The contacts from these relays shall be used as inputs to the PLC and as hardwired flame failure contacts wired in series with the latch valve.

Outputs from terminal 10 shall go to a hardwired relay. The contacts from this relays shall be used as inputs to the PLC and as hardwired flame failure contact wired in series with ignition transformer.

C.23. Combustion Valves & Piping

Physical piping shall be arranged for balanced distribution of gas to burners and shall also include manual balancing and metering orifice valves for fine tuning of combustion, where applicable.

All manually adjustable valves used for controlling air and gas flows shall be capable of being locked in their operating position, or be adequately covered and protected so that they cannot be inadvertently changed.

Swagelok fittings shall be used on all tubing connections.

Maximum length of impulse lines shall not exceed 15'-0 unless approved by Buyer. Transmitters shall be easily accessible by maintenance personnel and shall not be subjected to extreme heat.

All air and gas valve actuators shall be Beck Group 11 rotary damper drive, appropriately specified for required combustion performance.

All pilot air adjustments shall be protected by screw cover.

All sampling ports shall be provided with North American No. 1849-04 petcocks with hose nipple.



All preassembled combustion piping shall be clean internally, free of any oil, or other substance. Open ends of pipe shall be securely covered and protected so that the pipe systems are not contaminated during shipping and handling.

All components utilized in the combustion system's gas piping and control shall be appropriately certified for natural gas use.

Gas Stands

There shall be one gas stand/train for the furnace and one gas stand/train for each burner. The stand shall be pre-piped by Seller, and mounted to Seller supplied gas stand structure. Stand shall be prewired to Seller supplied terminal blocks in junction box, unless otherwise agreed upon with Buyer. Locations of all components shall provide for ease of maintenance and replacement. A Maxon motorized latch valve with FM proof of closure switch shall be used on each burner's gas train and two will be used on the main gas train, one automatic and one manual. Venting of the system components will be to safe location as indicated by NFPA 86 and confirmed by buyer. Vent lines for the natural gas system shall meet all the criteria of NFPA 6.2.6. Specifically, the vents shall be designed such that pressure from multiple regulators and switches of a single furnace, where piped to a manifold together, shall be piped so that any gas being vented from one ruptured diaphragm does not backload other devices. (Therefore, vent lines can be routed below grade as long as they meet the criteria of 6.2.6 and the routing is approved by the Alcoa Engineer.)

Main gas and pilot gas supply combustion control components (components common to all burners) shall be mounted on a floor mounted gas stand, unless otherwise agreed upon by the Buyer. The main gas shut-off valve shall be a lockable FM approved valve with safety exhaust on downstream side of valve. Gas stand shall have extra threaded 1-1/2" take off with shut off valve for Buyer's refractory dry-out equipment. Main gas regulator shall be mounted on the gas stand. One gas meter, a micromotion coriolis, with pressure and temperature compensation, shall also be mounted on the gas stand. Gas meter shall have a digital display on the meter for totalized gas and shall have an output connected to the furnace PLC. All safety devices, pressure switches (excluding air switches) shall be mounted on the gas stand.

The gas stands shall be fully assembled and functional at seller's site. Alcoa will do a supplier site inspection of all components and control operations on each of the stands prior to shipping.

The remaining gas combustion control components for each burner shall be mounted at the burner in an easily accessible location. Alcoa Engineering representative must authorize in writing their approval of location and description of all components that must be located on the roof of the furnace. Specifics surrounding Maintenance access shall be provided for all roof mounted components.

Pressure switches located on the furnace shall provide for stable operation, mercury type switches are not acceptable.

C.24. Burners

Bloom Engineering Low NOx Cold Air fabricated burners shall be used in this application, appropriately sized for optimum energy savings, while achieving specified melting performance. Seller shall provide a guaranteed fuel consumption rate based on the described scrap stream,

Seller shall review burner placement for optimized melt/hold cycle, minimal BTU/lb., and uniform molten metal bath temperature with Buyer prior to design concept approval and detail



engineering. Burners shall not be directed toward door openings or other openings in the furnace. Placement of burners and the method of their installation shall assure that the burners are easily accessible for maintenance, repair, and removal considering the maintenance required and the close proximity of adjacent equipment aisles.

C.25. Combustion Blower

A centrifugal surgeless type blower shall be supplied. Blower shall be installed on top of the furnace and shall be connected to a roof-mounted suction filter. The inlet of the primary combustion air blower shall be designed such that it pulls in fresh air from outside of building 134. (Additional blowers should consider using the same fresh air inlet if economically feasible.

Buyer requests that Seller evaluate filter unit for blower filtration, to minimize the frequency of maintenance. Blower shall have capacity to supply pilot air, air damper air (if applicable), and 115% of required combustion air required for maximum burner firing rate. Combustion air blower shall use a direct connected 1800 RPM TEFC motor. There shall be no pulsation in air lines when burners are off or on low fire. There shall not be a separate pilot blower.

Blower air chamber and blower bearings shall be equipped with seals to stop infiltration of dirt and dust into bearings. Blower shall be statically and dynamically balanced to within 0.5 mil displacement peak to peak to minimize vibration. Clearance with overhead cranes and runway steel shall be maintained. Blower installed on furnace roof shall not exceed 85 dBA at 3 ft. distance away at operator work areas at floor level below.

C.26. Emissions

Installed and functional combustion equipment supplied as part of this specification shall be proven to meet or exceed the following emissions levels for all modes of operation, verified at Buyer's monitoring point per USEPA methods and procedures:

Emissions Unit	tons/year
СО	7.21
NO _x	8.59
PM	0.16
PM ₁₀	0.65
PM _{2.5}	0.65
SO₂	0.05
VOC	0.47
Formaldehyde	6.4E-03
Hexane	0.155
Pb	0.0004
Total HAP	0.16
CO₂	10,306
CH₄	0.20



0.19

N₂O

CO₂e 10,369

Seller shall provide guaranteed performance values against each of these emissions units for the proposed combustion system for all modes of operation for review and approval by Buyer engineer prior to placement of purchase order.

C.27. Electrical Specifications

C.27.1 Control Panel & Operator Station

OPERATOR CONTROL BOOTH

Seller is responsible for designing and providing the physical operator booth building to contain the necessary operator interface equipment to monitor & control the furnace system as well as operating personnel. Equipment specifications will be provided by Seller at an early stage for Alcoa to evaluate and insure that the equipment meets with Alcoa standards and will be supported by the existing complement of spares that Alcoa maintains on-site. Seller will also be responsible for providing all equipment contained within the Operator Building. Seller is to route the AC condensate to the nearest drain.

Building Construction:

- Operator Booth shall be design to accommodate two (2) operators and space for four (4) people.
- Pre-fabricated steel building design that can be moved by fork truck or overhead building crane. Fork truck pockets and lifting eyes on all four corners are to be designed into the building structure.
- Building to have sound proof design to attenuate ambient noise levels in the 95 db range to a maximum of 82 db inside the booth.
- Man door shall have panic bar and window
- Fire/smoke detector and pull station linked to the plant wide Simplex System inside booth.
- Speaker system with one interior and one exterior speaker that is linked to the plant wide alarm system.
- PDP panel with disconnect
- Two (2) Outlets on each wall
- Lighted Exit sign and emergency lights above the door.
- Interior LED lighting on dimmer switch for brightness adjustment using 3500 K bulbs.
- Large viewing window that spans as much of the wall facing the furnace as possible.
- Industrial wall mounted HVAC System on dedicated circuit. (calculate heat load on 4 person occupancy)

The interior of the Operator Booth shall have at a minimum the following:

- All furniture and equipment are to be included.
- Include a flat working surface of approximately 60" x 30" & approx. 30" height that can be used for meals or paperwork. Can be free-standing or attached to the wall of the booth.



- Bank of four (4) outlets on work table
- Two (2) chairs (Heavy duty, 300 lb. capacity, tilt mechanism w/ tension control, pneumatic height adjustment, oversize casters, padded arm rests)
- Full-size refrigerator with dedicated outlet & electrical circuit.
- Microwave (w/ shelf attached to wall of booth; with dedicated outlet & electrical circuit.
- Toaster oven (w/ shelf attached to wall of booth; Dedicated outlet & electrical circuit in addition to the 2per wall)
- Water Cooler (Electric chiller w/ replaceable 3 gallon jugs)
- · Work space attached to the booth wall to include:
 - o 2 computer keyboards w/ 2 heavy duty sliding keyboard trays
 - Room for 3 desk mounted computer screens (Of approx. 30" dimension).
 Ergonomically located for neck position.
 - o 2 wall mounted monitors for camera video (Minimum 34 ")
 - o Base radio
 - o Telephone
 - o Printer
 - Dedicated 4-gang duplex outlet & circuit (in addition to the 2per wall)
 - Communications outlets on wall for computers and data monitoring of furnace systems

MAIN CONTROL PANEL

Provide the following PLC components:

- Main PLC ControlLogix Rack(s)
 - Allen Bradley ControlLogix L557x Processor programmed with version 24 of RSLogix 5000 Professional.
 - Ethernet card shall be provided (1756-EN2T).
- HMI preference Allen-Bradley PanelView Plus 7 with Ethernet, with same program build as the Pyro Panel HMI.
- Ethernet switch(s) shall be Stratix 5700.

All items shall be enclosed in a NEMA 12 Enclosure. All control devices shall be wired back to this Main Control Panel.

Control voltage of 24 VDC shall be used wherever possible. Where control voltages in excess of 50 V must be used, these circuits, devices and terminal blocks must be segregated from those that operate at less than 50 V. This is for maintenance personnel safety.

No 480 V power shall be present inside the Control Panel. This is for maintenance personnel safety.

All terminal blocks (groups of terminals) shall be identified with corresponding wire names as associated with PLC inputs and outputs.

No multi-layer terminals shall be used.



Each terminal shall be identified using plastic push-in tags that contain the terminal name on one side and the associated wire number on the other.

Plastic wire ways shall be designed so that field wiring does not share a wire way with panel wiring. This is to guarantee sufficient wire way space for the field wiring.

Sufficient "hots" shall be provided for PLC inputs and "Neutrals or Commons" for PLC outputs so that no more than one field wire must be connected to a terminal.

All 120 VAC power distribution wiring shall be black, 120 VAC control wiring shall be red, and 120 VAC Neutrals shall be white.

All 24 VDC control wiring shall be blue.

For instrumentation circuits, Red shall be used for + to the field device and Black shall be used for – from the field device.

All wiring shall be marked at each end with the wire number shown on the associated schematic using permanent plastic sleeve markers.

The Main Control Panel shall be equipped with a panel light and convenience receptacle. The light shall turn on only when the control panel doors are open.

The Main Control Panel shall contain a convenience receptacle and Ethernet connection that is accessible with the control panel doors closed. The receptacle and Ethernet connection shall include spring-loaded covers to protect against dirt when not in use.

PYRO PANEL

The Seller shall provide a Pyro Panel complete with Human Machine Interface (Allen-Bradley PanelView Plus 7 with Ethernet) and all control devices necessary to routinely operate the furnace. This is the operator's interface with the furnace controls.

This Operator Station shall be free-standing and will be mounted on the plant floor.

Allen Bradley 800T devices are the preferred control devices.

BURNER I/O PANEL

The Seller shall provide an individual Burner Related Panel(s) with all related burner components wired to Point I/O. All burner gas safety items shall be hardwired. (via Honeywell flame safety relay).

This Burner Related Panel(s) shall be free-standing and will be mounted on the plant floor.

Allen Bradley 800T devices are the preferred control devices.

MISCELLANEOUS PUSHBUTTON STATIONS

The Seller shall provide all other pushbutton stations required to facilitate maintenance and operation of the furnace such as local "Pilot Test" pushbuttons or "Door Up/Down" pushbuttons.

C.27.2 PLC Installation



The Seller shall provide a single PLC and associated I/O hardware (Point I/O) to control the operation of the furnace. The preferred PLC processor is an Allen Bradley ControlLogix.

PLC shall be in accordance with Alcoa Engineer Standard 26.19 and NFPA 86 2014.

Individual Circuit Breaker shall be provided for each Input PLC Card

Individual Circuit Breakers shall be provided for all Output Devices

C.27.3. PLC Programming Guidelines

The Seller shall organize the PLC program into separate tasks, programs and routines so as to simplify the navigation through the program when troubleshooting.

All Safety Logic required to safely start and shutdown the furnace must be separated from all other control logic and must be guarded from unauthorized modification by use of a password.

All conditions that result in a shutdown of the furnace shall initiate an alarm so that the operator knows specifically which condition shut down the furnace.

Any abnormal conditions shall initiate a message to the Human Machine Interface to alert the operator of that abnormal condition.

The HMI shall walk the operator through the Startup and Shutdown Sequences of the furnace. It shall also contain informational screens that specify actions to be taken in the event of an Emergency. This is to satisfy the requirement that the Startup, Shutdown and Emergency Procedures be posted at the Furnace.

C.27.4 Furnace Mounted Equipment

The Seller shall supply all field devices necessary for the safe and efficient operation of the furnace.

All field devices shall be installed so that they may be readily accessed for maintenance without forcing the removal of any other equipment.

Field-mounted devices shall be mounted and shielded so as to minimize their exposure to heat.

C.27.5. Electrical Equipment & Sensors

MOTOR CONTROL CENTER

The Buyer shall supply a single 480 Volt, 3 Phase, 60 Hertz power feed and a single 120 VAC, 1 Phase, 60 Hertz Uninterruptible power feed to the furnace.

All other electrical power distribution required for power and control of the furnace shall be furnished by the Seller.

The Seller shall supply a Motor Control Center (Allen-Bradley IntelliCENTER with Ethernet (– ALC Alcoa Standard) that will contain a main fused disconnect switch, control power transformer, control power distribution panel, power feeders and motor starters required for the furnace. Each individual motor starter bucket shall have an Allen-Bradley E300 Ethernet Overload Relay with 24 VDC supply. The MCC Buckets shall have an additional viewing window for the Ethernet Overload Relays. Each individual bucket shall have a control power transformer.



Devices used for Motor Control shall comply with <u>Specification MA4WGS-E-002 Motor Control</u> (Appendix B at the end of this document).

MOTORS

All motors shall comply with <u>Specification MA4WGS-E-001 Motors</u> (Appendix A at the end of this document).

Large blower motors (e.g. Combustion Air Blower, Exhaust Air Blower) shall use an Allen-Bradley Powerflex 755 drive with Ethernet communications.

Small drive applications (e.g. Circulation pumps) shall use an Allen-Bradley Powerflex 753 drive with Ethernet communications.

OTHER FIELD DEVICES

The normal state of all control device contacts shall be chosen so that an open circuit does not result in a dangerous condition.

The preferred vendor for field-mounted transmitters is Rosemount.

The preferred vendor for modulating valve actuators is Harold Beck and Sons.

All local disconnects shall be square-D or Eaton with viewing window

Provide local disconnects for fans, door drives, flue damper, all electrically powered actuators. (Note: A Circuit Breaker equivalent of a single lockout point could be acceptable, but must be approved by Alcoa Engineering)

Provide 10ea Auxiliary 110V outlets around furnace

Provide a minimum of 4ea 480V, 60A welding outlets around furnace w/ Russellstoll Model 8414 receptacles, or equal. (There must be two located near each furnace door for cooling fans, and one on each side of the furnace.)

The furnace door hoist systems shall be electric.

The jib cranes for replacing the Molten Metal Pump & Recirculating Pump shall be electric. The jib crane shall be adequately shielded from the heat emitted from the molten metal to prevent failure from excessive temperatures.

The MCC Buckets shall have viewing a window for Ethernet Relays

SMRL/High Temp Cabling shall be used for components on or near the furnace and burners

Cooling systems shall be installed for all panels with PLC/Smart Electronics

Rockwell/Allen-Bradley Intellicenter MCC with Ethernet based Communications shall be used

C.28. APC Lime Injection Bag House

The APC System (Line Injected Baghouse) shall be designed for fully automated and continuous operation 24 hours/day, 7 days/week, to control the air quality of the Coated Scrap Melting Furnace and Collection Hoods.



The APC System proposed must be capable of fitting in one of two places. The two potential locations are:

- a. Outside the south wall of Bldg. 134, between columns A11 and A14
- b. Outside the north wall of Bldg. 134B between columns E10 & E12. (Note: Bldg. 134Z that is located just west of column E12 can be removed if necessary.)

The Seller must coordinate with the CSM Supplier to design the baghouse to capture the emissions created by the newly designed Coated Scrap Melting Furnace. The Seller/Baghouse Supplier will be responsible for meeting emissions discharge limits described below, based upon the written furnace emission estimates from the CSM Supplier.

Seller will evaluate the two above potential baghouse locations and propose to Alcoa the most economical "Turnkey Option." This will include the total installed cost that will include all equipment relocations, building relocations, foundations, duct & supports, and total installation & commissioning costs.

This equipment must meet all applicable Alcoa, Local, and State codes and standards. (The most applicable Alcoa standards are attached, but this is not an all-inclusive list and the fact that the standard and/or codes are not attached does not relieve the contractor from the responsibility of meeting applicable standards.)

Seller shall take into account maintenance access (define necessary clearances required) for all equipment with special consideration for items that the supplier knows will require "routine maintenance."

C.28.1. Design Criteria

The Seller shall meet all applicable local, state, and Alcoa standards.

The Equipment must arrive onsite in a manner to support the attached schedule.

The baghouse shall be located per one of the two locations described above.

All Seller provided equipment must meet the criteria associated with the attached Alcoa Specifications and Engineering Standards:

The stack must be a minimum of 10 foot above the highest point of the closest building.

The ductwork shall be designed for proper velocities, incorporate insulation as needed, duct preheater if necessary, and be designed to last a minimum of 20 years with the anticipated fumes and potentially corrosive condensation. Temperature of the flue gases must stay above the dewpoint of the flue gases until it reaches the clean air side of the baghouse.

The Seller is responsible for providing the bands or clamps that attach the ductwork to the duct supports that will be provided by others.

C.28.2. Communications where the Seller must exchange critical design information with another design company must include an approval process that includes "interface drawings signed by Seller, APC System Supplier (if subcontracted), Interface Designer, Construction Management Firm, and Alcoa. Seller is responsible for communicating to the local design company all the design criteria necessary for the local designer to properly size foundations and duct supports, including but not limited to the following:

a. Foundation reaction loads and anchor bolt locations



- b. Proposed duct routing (The proposed route will be reviewed by Alcoa and the Local Design Firm. If interferences are present or if the proposed routing will incur costly supports or modifications to existing equipment, then the Seller will have to work with Alcoa to develop a new plan to route the duct.)
- c. Location of all supports
- d. Necessary spacing for the supports. (This shall be a minimum of 25ft spacing, unless authorized differently in writing by Alcoa Engineering.)
- e. Reaction loads at each support
- f. Location, size and necessary projection for each anchor bolt.
- g. Detailed anchor bolt pattern that includes all dimensions to locate anchor bolts.
- h. Information on each base plate with thru holes diameters for each anchor bolt
- i. Elevation of each support.
- j. Weight per foot of duct sections
- Cut Section of typical duct that shows steel thickness, flange details, and if applicable insulation & wrap.
- Details of APC System Supplier provided bands or clamps to enable Local Design Firm to design adequate connection points for the duct supports.
- m. Location of doorways or maintenance access points if they may affect foundation layout or design.

 C.28.3. The discharge from the bottom hopper must be a minimum of 7'-6" clearance above
- C.28.3. The discharge from the bottom hopper must be a minimum of 7'-6" clearance above grade to allow a roll-off hopper to be located under the baghouse discharge for collection. (Clearance is defined as the lowest point on discharge side of the rotary valve adapter, where the bulk bags are attached.) Seller shall provide a complete complement of hoppers plus one spare. (A hopper for each cell, or collection point plus one additional hopper) The hoppers provided shall be from Applied Industrial Technologies for an "Open Top-Special Galbreath R1254-2, per quote # 504765503."
- C.28.4.The fan shall have an inlet damper installed or a VFD. (A direct drive fan is preferred. Belt-driven must be approved by Engineer)
- C.28.5.The discharge from the bottom hopper in the baghouse shall use "Rotary Airlock Valves." (See detailed information for valve below)
- C.28.6. The Seller must provide a Spark Arrestor on the inlet side.
- C.28.7. Fire Detection and fire suppression for the Baghouse System will be dictated by local codes & FM Global evaluation. Seller must submit the design to Alcoa's Insurance Provider (FM Global) for review and comments (They may require items such as Explosion Blow-out doors, Fire protections, etc.)
- C.28.8. The injection point for the coating media in the duct shall have a dispersion plate designed and provided by the Seller.
- C.28.9. The Seller shall provide a self-contained MCC building that will be furnished complete with all necessary equipment installed, tested and ready for use, i.e. 480V Motor Control Center, LED Lighting, 120V Power Source, Receptacles, HVAC, etc. (This includes all cost for installation of power, control and/or instrumentation contained within the building.)
- C.28.10. The Seller shall provide a Bindicator to indicate if a bag is full on discharge portion of the hopper.
- C.28.11. The Seller shall provide a motion detection switch for proof the Rotary Airlock Valve is in motion.



C.28.12. Seller shall provide LED lighting for the inside of the lime building, the MCC building, over all exterior doors, and the exterior of the baghouse per ESD 32.10.1. (55 Foot-candles for MCC & Lime building,

C.28.13. MCC Building

The MCC building shall be a prefabricated building that is capable of being installed by either a fork truck or an overhead crane. The building shall incorporate fork truck pockets as well as lifting eyes on the top four corners of the building.

The MCC shall have a double door with a removable header that enables any of the electrical gear located inside the building to be replaced with adequate clearances for equipment moving devices.

The Seller will provide the necessary specifications for all power needs for this building. Others will provide the power "TO" the MCC & land the wires on the "Incoming Power" side of the gear inside the MCC.

The Seller will provide and install all components in the MCC as well as the MCC building.

The Seller will provide and install all conduit, cable, communication cables, etc. from the MCC to all items provided by the Baghouse Supplier.

The Seller will provide an MCC Layout consisting of a minimum of 25% spares. For example: If there are (3) 30A disconnects for field use, there will be at least (1) 30A added for a spare.

The Alcoa preferred MCC is a Rockwell/Allen-Bradley Intellicenter MCC with Ethernet based control.

A minimum of one fire/smoke detection device shall be included in the MCC building. This device shall be tied in to the plant wide Simplex Alarm system.

C.28.14. The Seller must provide a lime injection system for the lime. This must include a Feeder system capable of weighing & recording the volumetric injection rate of the lime. The conceptual design for this system must be submitted to Alcoa at the earliest possible stage to enable Alcoa to review the proposal to insure it meets with Alcoa's current Best Practices.

C.28.15. Lime System

The Seller shall provide the necessary specifications for all components for this building.

The Seller shall provide and install all power feeding the Lime System Equipment as well as the Lime Building proper. The building will have sufficient room for maintenance of all equipment, clearances for switches and other electrical components. Maintenance platforms shall be included for accessing items that require routine maintenance. Seller shall calculate the minimum and maximum lime usage to meet the discharge standards based on an agreed to scrap material quality and VOC quantities. Seller shall guarantee the maximum lime volume needed to comply with emission standards.

The components included in the Lime System will include the following:

- Lime Silo
- Insulated, heated, and humidity controlled Silo
- Tractor/Trailer loading station & equipment to fill the lime silo



- The lime injection equipment will be located as close as possible to the injection point in the duct.
- Conveyor weigh load cells to monitor real-time injection rate of lime. (Or other system proposed by supplier and approved by Alcoa Engineering.)
- The lime injection piping where the lime is physically introduced shall have the
 necessary sensors installed to provide real-time indication that the lime is not feeding
 properly. (Differential Pressure sensors are preferred, but other systems can be
 proposed by supplier and installed if approved by Alcoa Engineering.)
- The lime system shall incorporate a blower to assist the introduction of lime into the duct system. Alcoa Engineering must approve the specific type of "boosted injection system."
- The injection point for the coating media in the duct shall have a dispersion plate designed and provided by the Baghouse Supplier, and approved by Alcoa Engineering.
- C.28.16. Seller will design & provide a minimum of three temperature sensors for continuously monitoring the temperature data for the baghouse fumes. (One sensor near the point of fume collection adjacent the furnace collection hood, one monitoring the inside temperature of the Ingot Plant very near the Operator booth, and one near the baghouse inlet.)
- C.28.17. The Seller shall design the Capture Hoods to meet the criteria for airflow capacity specified by Chapters 3 and 5 of the 23rd edition of the Industrial Ventilation Manual. (As well as Secondary MACT requirements and all other applicable criteria spelled out in this publication.) The supplier shall provide the design calculation for this to Alcoa Engineering for approval, prior to the beginning of fabrication. These calculations shall require at the minimum:
 - 1. Worst case scenario with maximum fume capture criteria as determined by furnace manufacturer (e.g. the furnace is on high fire, furnace is being charged, furnace is being skimmed, etc.)
 - 2. Signed by a register professional engineer in the state of Indiana.
- C.28.18. The upper plenum must be designed to be accessible for ease of changing bags, cage removal, and any other required recurring maintenance activities. (Sufficient height for personnel to stand vertical and not have to crawl around on their knees.)
- C.28.19. The stack shall have a "Broken Bag Detection System" installed. The supplier shall purchase the Broken Bag Detection system, provide the necessary connection points in the stack and any necessary platforms for maintenance of this system. The system the Baghouse Supplier shall provide shall be a *PCME Stack990 unit with Ethernet and a sensor*. The PCME shall be mounted a minimum of 0.5 duct diameters downstream of the test ports in the stack. It shall be easily accessible for maintenance purposes and have ample slack in the wiring for easy removal.
- C.28.20. The stack shall have test ports, any necessary platforms to "SAFELY" access the test ports for testing, and any necessary handling equipment to enable the testing equipment to be ergonomically handled for insertion & removal in the stack testing ports. Platforms must extend a minimum of 8 ft. beyond the test ports to enable testing personnel to insert testing probes that are a minimum of 8 foot long. The platforms will wrap around 180 degrees of the stack, centered on the test ports. Stack discharge is estimated to be 60 ft. but seller shall comply with all federal, state, local, and Alcoa discharge requirement!

The test ports shall be:

 Installed at two different locations. One location shall be prior to the lime injection point, and one location shall be in the exhaust stack to atmosphere (downstream of the baghouse)



- 2. Two test ports at each location, at 90 degrees to each other in duct or stack
- 3. Test ports shall be 6" diameter pipe w/ threaded caps provided.
- 4. The test port shall not be within seven (7) diameters downstream and two (2) diameters upstream of the nearest disturbance.
- -5. Test Ports shall have a minimum of access platforms and monoral attachment points per the attached documents labeled: (Alcoa Engineering MUST approve the drawings associated with the access platforms and equipment is adequate, prior to the supplier beginning fabrication of platforms.)
 - i. Test Ports Monorail Setup
 - ii. Test Ports Platform Spec
- 6. If a test port is located in a horizontal run of duct, the test port facing straight up must have a structure provided that has the below criteria so that the testing equipment can be safely installed and secured:
 - a. Have an attachment point (e.g. eye bolt, shackle, etc.) located directly above the test port.
 - b. Attachment point is capable of supporting 25 lbs
 - c. Attachment point is located a minimum distance of "Pipe Diameter Plus 3 Feet" above the test port.

C.28.21. Flow rate will be dictated by the CSM Supplier's design of the Capture Hoods.

C.28.20. The Seller must guarantee the following stack output emissions to be LESS THAN:

- a. 0.005 grains/dscf
- b. 100 TPY CO
- c. 40 TPY NOx
- d. 40 TPY SO2
- e. 40 TPY VOC
- f. 25 TPY PM
- g. 15 TPY PM10 (Includes condensable emissions)
- h. 10 TPY PM2.5 (Includes condensable emissions)
- i. 0.6 TPY Pb

C.28.23. The Seller shall design the system with the below criteria included:

- a. APC System shall be structurally designed to the most recent versions of the Alcoa Engineering Design Standard 33.012 and the International Building Code (IBC). Structure shall also be designed for local area seismic requirements (see below).
- Style: Pulse Jet (Designed for 80 psi, maximum compressed air supply)
- c. Hopper Style: Pyramid with 70 degree valley angle (no screw conveyor required)
- d. Gross Air to Cloth Ratio: 3.125/1
- e. Net Air to Cloth Ratio: 3.75/1 (with one unit out of operation)
- f. <u>Can Velocity</u>: Specified based on estimated bulk density of fumes from furnace and lime to be injected. If using the same lime as we have for the R/F then Alcoa can provide this specification.
- g. <u>Ductwork:</u> All ductwork shall comply with Alcoa Environmental Engineering Standard drawings A100590-PX, A-100591-PX, A-100592-PX, A-100594-PX, A-100595-PX, A-100597-PX, A-100598-PX, A-100599-PX, A-100601-PX, and A-100602-PX.
- h. Exhaust Fan: Shall be VFD controlled and have vibration monitoring.
- i. <u>Static Mixer:</u> Shall be designed to create a reaction zone for thorough mixing of the hot gases with the injected lime.
- j. <u>Structural Components:</u> Supplier shall provide structural steel supports, access ladders or stairways (which are preferred), and platforms for equipment installation, operation,



- and maintenance of the APC System. This work shall comply with Alcoa Engineering Standard 33.013.
- k. <u>Noise Limitations:</u> the APC System and any of the components shall be less than or equal to 85db and comply with Alcoa Noise Standards 31.3.1.
- I. <u>Electrical Components:</u> All electrical components and devices shall meet current NEC and UL standards. Equipment meeting only IEC standards <u>IS NOT ACCEPTABLE.</u>

m. Components:

- i. Alcoa would prefer to use valves that are already in service on other equipment to minimize our need for spares. If possible, Alcoa would prefer for the supplier to use ACS Model CI 8x8, 0.20 C.F.R Rotary Airlock Valve complete w/ operator, zero speed switch, & epoxy coated rotary pockets. (Or propose another option that must be approved by Engineer.)
- ii. Prefer Allen-Bradley L5572 PLC w/ Stratix unmanaged switches with the switches matching the Rockwell/Allen-Bradley part # associated with the MCC design.
- iii. Rosemount (or approved substitute) with non-clogging differential pressure transmitters
- iv. Auto air-purge valves for compressed air cleaning headers
- C.28.24. The discharge from the rotary valve will have an adapter designed and attached to the outlet flange per Alcoa drawing A-147262-WK, and shall include the Bindicator (Item 1K) as shown. This will enable a discharge bag to be attached to the discharge side of the rotary valve for 100% containment of particulates.
- C.28.24. The Seller shall provide two (2) complete sets of collection bags. (A set for contractor to install for operation and one complete set of spares.) Seller shall provide collection bag per attached VP1448863-3SI (SP) Rev 2.0 from PACTEC, Inc.
- C.28.24. Seller shall insure that access platforms are provided for all areas and equipment that require routine access. Access must be provided to elevated work surfaces (Stairs are preferred but ladders are acceptable after approval by Alcoa Engineering)
- C.28.24. Seller shall insure that the design makes provisions for energy isolation devices for LOTO. This includes lockable handles on all valves that can be used for LOTO & local electrical disconnect switches for all equipment. A blank must be provided for the duct on the inlet side of the baghouse. This blank must be easily installed and removed and have easy access. (E.g. a slide gate w/ a maintenance platform)
- C.28.25. Seller must provide the electrical power needs for the equipment being installed.
- C.28.26. Seller must provide the PLC, I/O, and the electrical communication needs for the baghouse equipment being installed. The PLC must meet the attached Alcoa standards for PLC's. (Alcoa will be responsible for providing a PLC to communicate between the Baghouse components and the Alcoa equipment interface.)
- C.28.27. Seller must identify "DETAILS" for all "Takeover Points" for the supplier provided equipment, including required flow rates & pressures for utilities.
- C.28.28. Shipping methods, the way each load is positioned on the truck, the type of truck used for delivery, the delivery dates, and rigging plans for unloading will be communicated through the Construction Management company BEFORE any deliveries are made to Warrick Operations.
- C.28.29. The rigging points and center of gravity for each load will labeled and communicated to the Construction Management Company.
- C.28.30. Storage requirements must be provided for all items shipped to Warrick Operations.



- C.28.31. On-site storage is limited and the manufacturer may be required to store materials at their location for a period of time before shipping. (This must be coordinated with the construction management company)
- C.28.32. Seller must provide a detailed. "Responsibility Matrix" that indicates what items shall be provided by supplier.
- C.28.33. Seller shall provide a recommended list of spare parts. Alcoa & Seller/Baghouse Supplier shall jointly agree to the spares that will be provided as a part of this contract. The below list is the MINIMAL amount of spare parts that the Baghouse supplier will be required to provide as part of this contract:
 - a. One complete set of bags
 - b. Two sets of blower drive belts (If belt-driven fan is selected)
 - c. Rotary Valve

C.29. Fire Protection System

- C.29.1. Seller shall subcontract design of a fire protection system(s) to approved contractors Inergen and Simplex.
- C.29.2. Seller shall purchase and install designed fire protection equipment.

C.30. Engineering and Equipment Documentation

The stages and deliverables for the engineering and related equipment documentation for this project are defined below. Seller is responsible for provided complete as-built drawings. All documentation and drawings shall become the property of the Buyer upon project completion. All drawings and other documentation as directed by the Buyer's engineer as follows:

- C.30.1. Provide 3 ea. Flash drives of all drawings & cut sheets associated with this design after the "checking" phase is complete, and before the construction phase. (Issued for Construction Drawings)
- C.30.2 Provide 3 ea. Flash drives of all drawings & cut sheets associated with this design after all "As-Built" drawings are completed. NOTE: All thumb drives submitted will have the date upon which the thumb drive was created clearly labeled near the title block.
- C.30.3 Provide 3 ea. Sets of 3 ring binders and 3 flash drives of Manuals as specified in C.36 below.

C.31. Drawings

Drawings to be supplied as part of this project will include: general arrangements, foundation drawings, mechanical assembly drawings, mechanical detail drawings, refractory assembly drawings, refractory detail drawings, structural steel drawings, mechanical schematics & piping layouts, electrical schematics & conduit layouts, electrical panel layouts, installation support drawings, and safety and maintenance support drawings and documents. Any revisions necessitated by the Buyer's comments on the approval drawings shall be re-submitted to the Buyer for approval in the same manner in which the original drawings were submitted.

Preliminary Engineering:

Preliminary drawings and schematics showing the proposed design and arrangement of the equipment, foundations, refractory, combustion, exhaust and pressure control systems, required utilities, related calculations, sequence of operations, and control scheme shall be submitted to the Buyer engineer for approval, after an order has been placed for the equipment, prior to the start of detail engineering. More specifically, this information shall include:



- Equipment layouts (plan, elevations, sections)
- Foundation requirements (pits, trenches, loads, anchoring plan)
- Utility connections and requirements
- Interface Physical connections (exhaust system, molten metal transfer troughing, etc.)
- Furnace combustion, pressure control, exhaust system concept (including related heat balance and thermal modeling)
- Refractory design (including bills of materials, general material data sheets, and heat loss calculations)

Those major component purchases that must be ordered in advance of the detail engineering approval described below in order to maintain the overall project schedule shall be identified and approved pending review and approval of the proposed application by the Buyer's engineer. For example, review of proposed combustion system, related heat balance, and proposed operation shall be reviewed and approved prior to the purchase of the burners and related equipment.

Detail Engineering:

Completed equipment detail engineering shall be reviewed and approved by Buyer engineer prior to the start of fabrication and of major component purchases not identified above. Presented information shall include all related schematics, piping layouts, component bills of materials, material data sheets, process set-points, and operating sequences. Detail engineering review shall include the following items:

- Equipment layouts and major sub-assemblies
- Final foundation drawings (including all final loading, anchoring, pits, trenches, curbing and related details)
- Furnace structural steel drawings (including calculations)
- Final refractory drawings and documentation (including heat loss calculations, installation, and dry-out documentation)
- Final combustion, pressure control, and exhaust system drawings and documentation
- Exhaust stack drawings (including structural and stack draft calculations)
- Electrical drawings and documentation (including schematics, wiring diagrams, conduit layouts, panel layouts)
- Pneumatic drawings and documentation

Project Completion:

Final "As-Built" drawings shall be submitted to the Buyer engineer for approval, following fabrication and run-off testing. Final drawings shall include all drawings required to manufacture, maintain, and troubleshoot the equipment. All detail drawings shall contain information relating to material type, mechanical properties, heat treatment, manufacturer part numbers, purchased materials, and applicable codes used in the design. In addition, final drawing package shall include:

- Index of drawings on one (1) "A" size sheet listing numerically all mechanical and electrical drawings supplied by Seller.
- Assembly and schematics (as applicable) for foundation bolt plan, air, combustion and refractory.
- Drawings and bills of materials of all Seller supplied equipment including assemblies, subassemblies and details.



 Drawings of equipment from other suppliers used with this furnace (such as burners, bearings, filters, combustion blower, etc.).

Three (3) copies of each mechanical and electrical drawing shall be submitted directly to the Buyer's engineers. All drawings will be detailed using English units, and will be supplied to the Buyer in AutoCAD version 2007 in .dwg format on electronic storage media.

C.32. Mechanical Drawings

All mechanical drawings shall be done on Buyer furnished "A" size title block or Buyer approved alternate. All electronic drawings shall be provided in AutoCAD 2007 or older version.

A typical assembly drawing shall indicate location of details and purchased items. Drawings shall be of such quality and detail that parts can be re-fabricated and/or re-ordered as necessary without having to supply additional information. Mechanical drawings shall include a list of reference drawings noting other associated drawings (such as assembly and detail drawings).

Mechanical general arrangement, major sub-assembly, and schematics shall be on Alcoa title block using Alcoa – Warrick Operations' drawing standards and drawing numbers.

C.33. Electrical Drawings

Electrical Drawing Conventions

All electrical schematics and I/O drawings shall be done on AutoCAD 2007. Buyer will provide samples of symbols and border. All electrical drawings shall be created with an Alcoa 36" wide by 30" high Border. Text and devices sizes shall be such that all are readable when the drawing is plotted on "D" size (11" X 17") paper.

One drawing number shall be assigned for all PLC I/O under the control of a single processor. One page shall be provided for each slot in each PLC chassis. Each page with the same drawing number shall be assigned a unique page number.

Seller shall include PLC wiring diagram showing interconnection of PLC components such as racks, power supplies, Ethernet/Fiber connections, etc.

Seller shall provide documentation for all electrical devices showing the setup conditions in both software and hardware. For example, dip switch positions of all intelligent PLC I/O cards. PID instruction setup and intelligent I/O software setup.

All of these electrical drawings shall be provided on Alcoa title block using Alcoa –Warrick Operations' drawing standards and drawing numbers.

C.34. Seismic Design

- C.34.1 The Seller should provide complete seismic design and installation for furnace structure, baghouse structure, lime silo, ductwork, piping and cable tray that are part of their design
- C.34.2 Seller shall exchange critical design information to the Alcoa engineering contractor for utilities work so seismic designs function properly together.
- C.34.3. Equipment shall be structurally designed to the most recent version of the Alcoa Engineering Design Standard 33.012 and the International Building Code (IBC). Below are only for reference:



- a. Roof Live Load = 20 PSF
- b. Snow Load 20 PSF
- c. Wind Load = 90 MPH
- d. Seismic Design = 2A

C.35. Work Excluded

C.43.1. Foundation design & Installation (Based on footprint and Reaction Loads provided by CSM Vendor)

C.43.2 Utilities and power design and installation to within 100 ft. of furnace or pre-defined Takeover Point. (Based on requirements provided by CSM Vendor.)

C.43.3 Building structure modifications (Based on requirements provided by CSM Vendor.)

C.36. Manuals

Seller shall furnish three (3) sets of equipment manuals per Engineering Standard 30.17, which shall include at least the following:

- 1. Installation / Startup,
- 2. Equipment Operation and Setup (for Production Personnel)
- 3. Equipment Operation and Setup (for Maintenance and Engineering Personnel)
- Lockout / Tagout / Tryout Procedures (for complete isolation of the system and isolation of any component which may require "on-line" service)
- 5. Mechanical Maintenance Procedures
- 6. Lubrication Schedule and Mapping of Lubrication Points
- 7. Mechanical Maintenance Troubleshooting
- 8. Electrical Maintenance Procedures
- Ladder Logic Listings
- 10. Electrical Maintenance Troubleshooting
- 11. Sequence charts and timing diagrams for all modes of operation indicating valve status, position and pressure data, and command and feedback signals for all phases of the machine cycle.
- 12. Preventative Maintenance Program (including daily checklists, weekly/monthly/quarterly/annual PM functions
- 13. Original Manufacturer's Specification Sheets Copies of original manufacturer specification sheets for purchased items. (Drawing numbers referenced for each item)
- 14. Recommended Spare Parts List: Mechanical, Combustion, Pneumatic, Refractory, and Electrical. (Drawing numbers referenced for each item)
- 15. Spare Parts List, including pricing, manufacturer, original manufacturer's part number, suggested supplier, and approximate lead time shall be sent for approval prior to shipment of equipment. NOTE: The spare parts list shall be provided no later than three (3) months prior to shipment of equipment to allow Buyer to purchase and have on hand the required spare parts during start-up and commissioning.

The manuals shall be organized in an "easy to read" format, bound in hard bound 3-ring binders with complete indexes and tabbed sections. Manuals shall include information of manufactured systems and purchased systems included in this specification. Operating and Maintenance Instructions, which shall include manufacturer's spare parts lists and instructions covering all mechanical and electrical purchased units, shall be submitted prior to equipment being shipped. Also included within the manual shall be required preventative and periodic maintenance tasks with their related frequencies (i.e. daily, weekly, monthly, quarterly, annually). It shall be the responsibility of the Seller to provide



these preventative and periodic maintenance tasks in a manner which quickly outlines the necessary maintenance for the entire system separate from that supplied for each component.

Spare Parts List:

The supplier shall include a listing of all critical components necessary for machine operation. The list will also include long lead time items, items which are not in the immediate access of Lafayette Operations, or items which are considered non-standard. (Drawing numbers referenced for each item)

It is essential that this equipment operates on demand and will not be down waiting on any component, electrical or mechanical. The supplier will inform the owner of any situation which may jeopardize the machine's operation.

Recommended Spare Parts Lists indicating the price, quantity, consumption rates, and lead times of each item shall be submitted to the Buyer's engineer and the Alcoa Purchasing Department no later than three (3) months prior to shipment.

C.37. Commissioning and Training

- C.37.1 Seller shall include forty (40) ten (10) hr. days for commissioning.
- C.37.2 Seller shall include four (4) ten (10) hr. days for training.
- C.37.3. Seller shall include two (2) ten (10) hr. day for training instrumentation personnel on combustion system, automation and trouble shooting.

C.38. Schedule

All work covered in these specifications shall be performed in a diligent manner. Seller shall advise Buyer of proposed start and completion dates for the following items for the Buyer's review prior to placement of purchase order. A Gantt chart in Microsoft Project will be acceptable. Start and Stop dates for each of the following items shall be included, broken into further detail as required to track critical path items:

- 1. Preliminary Engineering (TBD)
- 2. Detail Engineering (TBD)
- 3. Equipment Fabrication (TBD)
- 4. Pre-Shipment Performance Testing (TBD)
- 5. Equipment Delivery To Site (TBD)
- System Installation (TBD)
- 7. System Commissioning (Charge Furnace: TBD)
- 8. Site Performance Testing (TBD)
- 9. Spare Parts Delivery To Site
- 10. System Final Documentation (TBD)
- 11. System Training (TDB)
- 12. Final Acceptance 11/22/2019

C.39. Pre-shipment Inspection, Equipment Testing

Inspection:

The Buyer reserves the right to visit Seller or Seller contractor facilities at any time during all phases of the project to inspect equipment progress in advance of shipment. The Seller-supplied



furnace steel work shall be fully assembled for inspections by the Buyer's engineer prior to shipment from the fabrication point.

The following shall be forwarded to Owners Engineer before shipment of any fabricated component:

- 1. Welding certifications for all personnel working on the fabrications
- 2. Welding procedures
- 3. QA documentation for weld verification and documentation

All mating parts shall be match marked.

Equipment Testing:

Seller shall furnish all equipment, materials, and labor for testing of equipment prior to shipment. Equipment to be tested shall include but not be limited to the following:

- 1. Pressure testing of combustion control stand.
- 2. Dynamic balance of all blowers. Blowers shall be balanced per Engineering Standard 31.4 "Vibration of Rotating Equipment" and run tested.
- 3. Programmable Controller Logic.
- 4. Sound power level testing of combustion air system.
- Electrical panels provided by Seller.

The Buyer reserves the right to have all tests witnessed by the Buyer's engineer or representative. Seller shall notify Buyer of test date at least two weeks ahead of all tests to be conducted.

D. PERFORMANCE AND ACCEPTANCE TESTING

D.1. Coated Scrap Melt Furnace

D.1.1 Performance Requirements

Note that all testing associated with the Baghouse (separate specification) shall be coordinated so that it coincides with the below described Furnace testing. The Furnace can't pass its Acceptance Test if ANY of the Baghouse criteria fails during the below described Furnace Acceptance Procedures. The Furnace will not be accepted until the Baghouse passes all required testing.

The following describes specific performance criteria used to verify the acceptable performance of Seller equipment. Any revisions to these requirements must be agreed to by the Buyer and Seller prior to testing. Seller shall furnish all test equipment and support personnel for the duration of the *Performance & Acceptance Testing* described below.

- TEMPERATURE RECOVERY Furnace shall be designed to increase bath temperature from 50 degrees below bath setpoint to setpoint within 30 minutes. Recovery capability is required for the full range of charge weight.
- 2. Aluminum shall not freeze in the pump well during melt and hold cycles.
- 3. INGESTABLE SCRAP VORTEX MELT RATE shall be 10,000 lbs/hr. for continuous melting of scalps chips, and auto-shred fed through the proprietary Alcoa Vortex.
- 4. CLASS 2 BRIQUETTED OR BALED MELT RATE shall be 30,000 lbs/hr. for melting coated materials charged onto the raised hearth section of the multi-chamber furnace using the Glama charge machines.
- 5. FURNACE PRESSURE AT THE SILL shall be maintained at a minimum positive pressure of 0.010 inches of water for complete range of firing rate over furnace cycle.



The furnace pressure will be captured via a Differential Pressure Cell with a port in the lower wall of the furnace that will be located some distance above the sill level. The OEM shall provide the calculations to determine the "Measured Pressure" at the Dp location that corresponds to 0.025 inches of water at the sill level.

- 6. NOISE generated by this equipment shall not exceed 83 dBA at 3 ft.
- MAXIMUM OUTSIDE FURNACE STEEL SHELL TEMPERATURE shall not exceed 200 degrees F side walls.
- 8. GROSS FURNACE CAPACITY shall be agreed upon by Alcoa/Vendor during design phase.

D.1.2 Test Guidelines

The Acceptance Tests will be performed after at least 1 month of furnace operation, but within 6 months of startup. The testing is expected to take 1 to 2 weeks and will be performed on day shift only, 10 hours per day, Monday through Friday.

The following describes the testing procedures used to measure Instantaneous Melt Rate (IMR), BTU per pound to melt and hold, and temperature control.

Each of the test cycle steps listed below will be used to accurately quantify the furnace performance capabilities:

- Material Ingestion/Melt Test (3 separate tests for each of 3 material classes. There
 is a total of 9 tests)
- 2. Temperature Hold/Recovery Test
- 3. Metal Temperature Transfer Test

Each of these test cycle steps is described in more detail in the following pages. A detailed procedure, data collection forms, and related charts will be developed prior to performance testing.

D.1.3. Ingestible Class 2 Loose Vortex Test Procedure

- The furnace shall be stable for a minimum of 12 hours prior to the beginning of the test.
- 2. Turn the circulation pump on and establish circulation of molten metal through the vortex. The metal temperature will be at 1435 degrees before starting the metal conveyor and feeding Class 2 loose scrap to the vortex.
- 3. The tubs of Class 2 loose scrap will be weighted and the weights of each tub recorded.
- 4. The loose scrap will be fed at a rate of 10,000 lb. /hr. for a continuous 10 hour period via the conveyor.
- 5. Remove 4 cruces (Approx. 60,000 lbs) from the furnace, in rapid succession (in approximately 20 minutes), every time the maximum furnace level is achieved. (This should take approximately 3 hours)
- 6. Weigh the metal in each cruce and record the weight.
- 7. Continuously monitor the bath temperature of the furnace. The bath temperature should not vary by more than +/-20 degrees F.
- 8. Measure the level of the molten metal at the tap well before and after each round of 4 cruces is removed from the furnace. Record metal level, time, weight of loose scrap ingested, and weight of metal removed via cruces.
- Fuel usage shall be monitored and recorded throughout the acceptance test. A final report document will be provided to Alcoa showing furnace fuel usage meets the OEM guarantee.



D.1.4 Class 2 Briquetted or Baled Melt Rate Test Procedure

- The furnace shall be stable for a minimum of 12 hours prior to the beginning of the test!
- 2. Turn the circulation pump on and establish circulation of molten metal through the vortex. The metal temperature will be at 1435 degrees before starting to charge the Class 2 Baled scrap. (This must be performed during the same timeframe when the *Transfer Trough Temperature Test* is being performed.)
- 3. Charge baled scrap through the charge door at the rate of 30,000 lb. /hr. for a continuous 10 hour period. (Determine weight of baled scrap by use of the "Charging Scale.")
- 4. Remove 4 cruces (Approx. 60,000 lbs) from the furnace, in rapid succession (in approximately 20 minutes), every time the maximum furnace level is achieved. (This should take approximately 2 hours)
- 5. Weigh the metal in each cruce and record the weight.
- 6. Continuously monitor the bath temperature of the furnace. The bath temperature should not vary by more than +/- 20 degrees F.
- Measure the level of the molten metal at the tap well before and after each round of 4 cruces is removed from the furnace. Record metal level, time, weight of baled scrap ingested, and weight of metal removed via cruces.
- 8. Fuel usage shall be monitored and recorded throughout the acceptance test. A final report document will be provided to Alcoa showing furnace fuel usage meets the <u>OEM</u> guarantee.

D.1.5. Mixed Material Ingestion Test Procedure

- The furnace shall be stable for a minimum of 12 hours prior to the beginning of the test!
- 2. Turn the circulation pump on and establish circulation of molten metal through the vortex. The metal temperature will be at 1435 degrees before starting to charge the scrap.
- 3. Charge Class 2 baled scrap through the door at the rate of 20,000 lb. /hr. and at the same time charge Class 1 Briquettes through the vortex system at the rate of 10,000 lb. /hr. for a continuous 10 hour period. (Determine weight of baled scrap by use of the "Charging Scale." The tubs of Class 1 briquettes will be weighed and the weights of each tub recorded.)
- 4. Remove 4 cruces (Approx. 60,000 lbs) from the furnace, in rapid succession, every time the maximum furnace level is achieved. (This should take approximately 2 hours)
- 5. Weigh the metal in each cruce and record the weight.
- 6. Continuously monitor the bath temperature of the furnace. The bath temperature should not vary by more than +/- 20 degrees F.
- 7. Measure the level of the molten metal at the tap well before and after each round of 4 cruces is removed from the furnace. Record metal level, time, weight of scrap ingested, and weight of metal removed via cruces.
- Fuel usage shall be monitored and recorded throughout the acceptance test. A final report document will be provided to Alcoa showing furnace fuel usage meets the OEM guarantee!

D.1.6. Temperature Recovery / Hold Test



- The furnace shall be stable for a minimum of 12 hours prior to the beginning of the test.
- 2. With furnace door closed, pyod in the bath, and the circulating pump running, turn the burners off and record time and other data identified on data collection form.
- 3. Monitor average bath temperature every 30 minutes as it cools until temperature reaches 1370 degrees F. When bottom bath temperature first reaches 1335 degrees F, record time and other data identified on data collection form. Set bath temperature setpoint to 1435 degrees F and turn burners on.
- 4. Record time and other data identified on data collection form every 10 minutes until bottom bath temperature first reaches 1435 degrees F, recording time and other data at this time as well.
- 5. Monitor the top, bottom, and average bath temperatures to determine the peak temperature before controller turns down. Record time and other data identified on data collection form when peak is reached. Stratification shall not exceed 5 degree F.
- 6. Monitor the top, bottom, and average bath temperatures to determine when the bath first cools to 1435 degrees F (or comes within 5 degrees of the bath setpoint). Record the time and other data identified on the data collection form. The temperature recovery test is over and the holding test begins.
- 7. Record time and other data identified on data collection form every 10 minutes until top, bottom, or average bath temperature has peaked at least two times after the initial overshoot. Hold test is complete.
- 8. Fuel usage shall be monitored and recorded throughout the acceptance test. A final report document will be provided to Alcoa showing furnace fuel usage meets the OEM quarantee!

D.1.7 Transfer Trough Temperature Test

- With the furnace metal level at maximum capacity, and while maintaining the bath temperature stable, fill a total of 4 cruces in rapid succession. (This must be performed during the same timeframe when the Class 2 Baled Melt Rate Test Procedure is being performed.)
- Monitor the temperature of the metal flowing through the transfer trough using a type K sheathed thermocouple. Record the readings for the bath temperature and Transfer Trough temperature every minute while filling the three cruces.
- Repeat above steps 1 & 2, two more times for a total of 3 cycles that will provide recordings for 12 cruces.

D.1.8 Measurement & Calculations

Defines the measurement systems and calculations that will be used in the testing procedures.

D.1.8.1. Metal Temperature Measurement

Bath temperatures will be controlled using type K Thermocouples inside Buyer's pyod assembly. This scenario will be evaluated during performance testing and adjusted as needed to address temperature stratification and operations methods. Pyod assembly adjustment shall be provided to calibrate thermocouple temperatures, allowing for refractory erosion, refractory buildup, etc. that impact bath volume.

In addition to the bath thermocouple, a type K sheathed thermocouple will be located in the molten metal circulation system, upstream of the circulating pump inlet, to measure temperature of the metal as it circulates between the different furnace chambers. This



thermocouple will not have a protection tube and will be intended to more accurately measure the temperature without the time delay and thermal inertia of a protection tube.

An additional type K sheathed thermocouple will be located in the tapping trough to measure temperature of the metal as it pumped into a cruce. This temperature will be compared to the bath thermocouple data to reflect actual cruce temperature versus bath temperature.

D.1.8.2. Calculations & Definitions

INSTANTANEOUS MELT RATE - The amount of metal charged divided by the time required to complete the melt cycle.

MELT CYCLE TIME - Time between when the furnace door was first closed (after charging) and when the average bath temperature reaches the bath setpoint.

MELTING BTU/LB. - Multiply gas volume consumed during the melt cycle time by the average BTU content of Warrick Operations' gas (Approximately 1,020 BTU per cubic foot) and divide result by the weight of metal charged into the furnace.

TEMPERATURE RECOVERY OVERSHOOT - Subtract the bath setpoint from the maximum average temperature of the bath and divide the result by the bath setpoint. The maximum temperature reading is the first temperature peak occurring after the average furnace bath has been cooled 50 degrees below setpoint and first reaches the bath setpoint.

TEMPERATURE RECOVERY TIME - Time between when the furnace burners are turned on (after cooling average bath to 50 degrees below setpoint) and the average bath temperature is within 5 degrees of setpoint after attaining the maximum overshoot temperature.

HOLDING BTU/HR - Multiply gas volume consumed during the hold cycle by the average BTU content of Warrick Operations gas (Approximately 1,020 BTU per cubic foot) and divide result by the total time of the hold cycle.

HOLDING TEMPERATURE VARIATION - Maximum average bath temperature minus bath setpoint determines positive error. Minimum average bath temperature minus bath setpoint determines negative error. These calculations are made after temperature recovery time is complete during the holding mode. At least two peaks will be recorded during the hold cycle.

METAL TRANSFER TEMPERATURE VARIATION - Maximum transfer trough temperature minus bath setpoint (target) determines positive error. Minimum transfer trough temperature minus bath setpoint (target) determines negative error. These calculations are made every minute while the cruce is being filled.

D.1.8.3 Furnace Shell Temperatures

- After the furnace has come to a stable operating state at 1435 degrees F, the furnace shell temperature will be tested. The target is 200 degree F on the cold face of the walls and 250 degree F for the hearth.
- 2. The shell temperature will be taken using a surface thermal couple at five (5) locations in the upper wall and five (5) locations in the lower wall.
- 3. These temperatures will be taken one (1) time a day for 1 week during the commissioning and averaged over the time period for final performance
- 4. For the furnace hearth temperature we will use the twelve (12) embedded thermal couples. These temperatures are the inside surface temperatures. Outside shell temperature will have to be calculated using thermal calculations!
- 5. These temperatures will be taken one (1) time a day for 1 week during the commissioning and averaged over the time period for final performance



⇒⇒ ∘ =D.2.=Uncoated Feed Conveyor System ∘ = ==

Acceptance Test Criteria:

The Seller must guarantee the following performance of the Uncoated Feed System:

Initial Operational Test:

- 1. Feed rate will be verified by weighing scrap on the Alcoa Charge Scale, feeding this scrap via front-end loader into the conveyor system, and timing how long the known weight takes to feed into the vortex bowl. The feed rate will be evaluated using a "rolling 3 minute average" and shall not vary by more than 10% from target.
- 2. The floor fed shaker shall be loaded with at least 15,000lbs, of material at the time.
- 3. Demonstrate the UFS is capable of feeding at the maximum design rate of 10,000 lb. /hr. for 2 hours. Hopper will be loaded with weighed scrap totaling 20,000 lb. Hopper will completely empty the 20,000 lb. of material over the course of 2 hours at the feed rate setpoint, and maintain that setpoint during the 2 hours based on a rolling 3-minute average, and shall not vary by more than 10% of the maximum rated capacity
- 4. Demonstrate the UFS is capable of feeding at a rate of 1,000 lb. /hr. for 2hours. The hopper will be loaded with weighted scrap totaling 2,000 lb. The hopper will completely empty the 2,000 lb. of material over the course of 2 hours at the feed rate setpoint, and maintain that setpoint during the 2 hours based on a rolling 3 minute average. The feed rate shall not vary by more than 10% of the maximum rated capacity.
- 5. Above items 1 thru 4 will be performed for all types of scrap ingested into this furnace, including but not limited to: (Total of 12 tests lasting 2 hours each)
 - i. Briquettes (Maximum size 30" x 16" x 16")
 - ii. Scalps
 - iii. _Auto-Shred
 - iv. Finishing Chips
 - v. Loose can lids
 - vi. Loose tab slugs
- 6. Demonstrate the weigh scale system accurately weighs product within 1% of Full Scale Capacity and that the value of the scale divisions is not greater than 0.5% of the rated capacity of the scale!
- 7. Demonstrate the weigh scale system communicates feed rate to the local HMI panel, the Operator Booth, and Citect accurately!
- 8. Demonstrate the scale calibration procedures produce accuracy.
- 9. Demonstrate the alarm and annunciation conditions are set and functional.

Final Acceptance Test:

After the furnace has been operating for 30 days the Supplier and Alcoa will run
the above acceptance tests:
 See above attached Acceptance Tests in sections D1.3 through D1.5 for the
acceptance test of the Vortex system. The Conveyor will be an integral part of
the tests described in these sections and must support the ingestion of scrap into

the vortex with absolutely no reduction in feed rate or overfeeding issues for the duration of these tests.



D.3. APC Lime Injection Bag House System

D.3.1. Performance Requirements and Testing

The following describes specific performance criteria used to verify the acceptable performance of Seller equipment. Seller shall furnish all equipment, materials, and labor for testing of equipment prior to "Turnover to Alcoa Production." Any revisions to these requirements must be agreed to by the Buyer and Seller prior to testing.

- 1. LEAK DETECTION Black light inspection of filtrations system to insure there is zero leakage between the dirty to clean side of the baghouse
- 2. NOISE generated by this equipment shall not exceed 83 dBA at 3 feet.
- 3. LIME WEIGH FEEDER SYSTEM Test to determine accurate federate of lime
- 4. STACK EMISSIONS Shall meet EPA & SMACT guidelines
- 5. CAPTURE VELOCITIES To meet Industrial Ventilation Manual criteria

D.3.2. Test Guidelines

- Within 60 days of the start of operations, Alcoa will hire a 3rd party to perform stack testing to insure the system meets all the above emission criteria.
- Sampling for stack testing will be conducted per 40 CFR 63.1510 and 1511 to determine compliance with secondary MACT.
- 3. Noise levels will be measured per ESD 30.3.1

D.3.3. Baghouse Leak Detection

- Bags will be installed, pre-coated with lime, and baghouse functioning per manufacturers design criteria.
- Particles designed for detection by a black light will be introduced into the duct on the inlet side of the baghouse
- 3. The black light will be used on the "Clean Side" of the baghouse to inspect for any particles that made it past the filtration system.
- 4. This process will be performed for each individual baghouse cell.

D.3.4. Noise

- 1. Baghouse & Lime equipment will be functioning per manufacturers design criteria.
- Alcoa EH&S personnel will measure noise levels per ESD 30.3.1
- 3. This process will be performed for each individual component that generates noise that could potentially exceed 83 dBA when measured at a distance of 3 feet.

D.3.5. Lime Weigh Feeder System

- 1. Lime equipment will be functioning per manufacturers design criteria.
- Contractor shall calculate the minimum and maximum feed rate based on the input scrap material quality agreed to by both parties. Contractor will then guarantee the maximum feed rate and lime usage requirement.
- A pre-determined amount of lime will be weighed and introduced into the lime feeder system. (The amount will be jointly determined by Alcoa & APC Supplier after the lime feed rate for this system is calculated.)
- The Lime Weigh Feeder system should measure the correct time-based supply of lime within +/- 1%.
- 5. This test shall be repeated and documented 3 times.

D.3.6. Stack Emissions

Note that Melt Rate testing associated with the Coated Scrap Melting Furnace (separate specification) shall be coordinated so that it coincides with the below described stack



testing. The APC system can't pass its Acceptance Test if the Furnace Melt Rate criteria is not met. The Baghouse will not be accepted until the Furnace passes all required testing.

Stack Testing to be performed by a 3rd party contracted by Alcoa per 40 CFR 63.1510 and 1511. Stack Emissions shall measure less that the below criteria to be acceptable:

- a. 0.005 grains/dscf
- b. 100 TPY CO
- c. 40 TPY NOx
- d. 40 TPY SO2
- e. 40 TPY VOC
- f. 25 TPY PM
- g. 15 TPY PM10 (Includes condensable emissions)
- h. 10 TPY PM2.5 (Includes condensable emissions)
- i. 0.6 TPY Pb

D.3.7. Capture Velocities at Openings

- 1. The APC System Supplier shall measure the velocities at the Capture Hoods to meet the criteria for airflow capacity specified by Chapters 3 and 5 of the 23rd edition of the Industrial Ventilation Manual. (As well as Secondary MACT requirements and all other applicable criteria spelled out in this publication
- 2. Measurements shall be taken at worst case scenario with maximum fume capture criteria as determined by furnace manufacturer (e.g. the furnace is on high fire, furnace is being charged, furnace is being skimmed, etc.)

D.3.8 Furnace Shell Temperature

E. FURNACE DRYOUT

The dryout will be per the manufacturers recommendation, all refractory vendors must approve of final dryout schedule.

The dryout for the new refractory lining installed in CSM furnace will be done by Contractor forces using Contractor equipment. Contractor forces will block the flue and install the dryout wagon burners under the partially raised front door.

The contractor shall install the thermocouples in the furnace refractory lining per buyer's requirements after design is complete. The contractor shall supply necessary thermocouple wire to connect the thermocouples in the refractory lining to a common monitoring point. The contractor shall put labels on each wire, transfer the wire numbers to the drawing to record the location of the thermocouple in the furnace lining, bundle the wires to the central collection location chosen by Alcoa and check-out the continuity of each wire.

F. STANDARDS

Standards - For Engineering / Construction

The following Alcoa standards apply to this work. The most stringent rules apply if there is a conflict. A paper copy of the listed Alcoa standards will be provided in each bid package.



Alcoa Standard	Dated	Title
Warrick standard	Most recent	Warrick Operations Safety & Health Rules 2008 - green book
7.6	3/2009	US Drawings
7.8	3/2009	Assembly and Detail Drawings
7.13	3/2009	Electrical Documentation
16.1	9/2009	Piping System Identification of Content
16.3.1	9/2009	Piping Design and Material Specifications General Design Guideline
16.3.1	9/2009	Piping Design and Material Specification Summary
16.3.1.1	9/2009	Valve Selection Reference
16.5.1	9/2009	Shop Fabrication Specification for Pipe
18.1	10/2010	Entering and Working in Confined Spaces
18.1.1	2/2008	Respiratory Protection
18.2	10/2010	Fall Control
18.3	10/2010	Tagout/Lockout/Verification Procedures
18.4.2	6/2012	Prevention of Explosions of Aluminum Fines and Dust
18.4.3	3/2014	Combustible Particulate Safety
18.6.1	4/2010	Safe Handling of Compressed Gases
18.14	4/2010	Welding and Cutting Containers
18.21	6/2009	Safety Color Painting
18.23	11/2010	Machine Guarding
18.23.1	11/2010	Machine Guarding Guidelines
18.28	6/2006	Personal Protective Equipment Program
18.30	12/2007	Fatality Prevention Program
18.31	8/2008	Secondary Flame Resistant Garment Requirements
18.31.1	8/2008	Flame Retardant Garment Matrix for Secondary Clothing
20.8		Alcoa Shaft Alignment
26.19	11/2007	Product Heating System Safety
26.19.1	11/2007	Product Heating System Safety for the United States and Caribbean
26.19.2	2/2008	Instructions and Application for Acceptance of Product Heating or Combustion Systems
26.9	12/2009	Specification for Fabricating Components—Molten Metal and
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		Processing Furnaces
30.3.1	1/2010	Noise Levels of Stationary Equipment
31.4		Alcoa Vibration of Rotating Equipment
30.17	10/2010	Equipment Operating and Maintenance Manuals
30.36	3/2006	Determination of Mobile Equipment and Mobile Equipment
		Operator Medical Evaluations
30.36.1	3/2006	Free Moving Mobile Equipment Safety
30.36.1.1	3/2006	Mobile Equipment and Pedestrian Segregation
32.2.2	11/2009	Alcoa Modifications to ANSI/NFPA 79 Titled "Electrical
		Standards for Industrial Machinery"
32.5.1		Noise Immunization of Electrical Control Systems
32.9.1		Power Supplies for Electrically Sensitive Equipment
32.10.1		Recommended Maintained Levels of Illumination for Design
32.25.3	9/2009	Motor Control Centers
32.63	12/2009	PLC Systems
33.052.1	4/2010	Safety and Health Evaluation of Outside Contractors and
		Subcontractors
33.013		Design, Construction, and Installation of Fixed Platforms,
		Walkways, Stairways, Ladders and Floor Openings
33.055.1	1/2010	Contracted Services Safety Prequalification Questionnaire
33.211.7	5/2010	Specification for Structural Steel Materials and Shop Fabrication
33.211.7A		Structural Steel Material Appendix
33.218.2		Alcoa Paint Specification
33.218.7		Specification for Painting Steel - Materials
33.218.8		Specification for Painting Steel and other Surfaces -
		Workmanship
35.2.7	9/2008	Specification for Rust Preventative Coatings
35.4.1	12/2008	Corrosion Protection of Machinery and Equipment Storage and
		Erection
47.0.2	10/2008	Prevention of Explosions in Molten Aluminum Operations
A-100590-PX		Alcoa Environmental Standard Drawing - Duct, Fab, &
		Installation Notes, 300 F Max. Temp.
A100591-PX		Alcoa Environmental Standard Drawing - Flange & Gasket
		Schedule



A100592-PX	T	Alcoa Environmental Standard Drawing - Flange & Gasket
/11000021/	NP	
		Schedule
A100594-PX		Alcoa Environmental Standard Drawing – Duct Supports
A100595-PX		Alcoa Environmental Standard Drawing - Duct Supports
A100597-PX		Alcoa Environmental Standard Drawing - Duct Saddles
A100598-PX		Alcoa Environmental Standard Drawing – Duct Saddles &
		Supports
A100599-PX		Alcoa Environmental Standard Drawing - Duct Support
		Attachments
A100601-PX		Alcoa Environmental Standard Drawing - Air Inlet Sections &
rs.		Details
A100602-PX		Alcoa Environmental Standard Drawing - Cleanouts, Slide
		Gates, Test ports, and Sample Ports
ALCOA REFRACTOR	Y INSTALLATION :	STANDARDS
RTF Spec	Specification for P	Pre-Cast Refractory Shapes (Not Big Block)
Appendix D		To calculately chapter (contag bloom)
RTF Spec	Workmanship and Installation Standard for Large Block Refractory Linings and	
Appendix E	Backup Insulation	
RTF Spec	Workmanship and Installation Standard for Brick Refractory Lining in Aluminum	
Appendix F	Melting and Holding Furnaces	
RTF Spec	Workmanship and Installation Standard for Castable Refractory Lining in Aluminum	
Appendix G	Melting and Holding Furnaces	
F-125836-004	Refractory Anchor High Alumina Series – 858-17 Anchor	
A-188514-WK	70 Ton Holding Furnace 1 E/W Furnace Refractory – 6M2 Refractory Fastener Details	
A-189624-WK	EMC Casting Unit No.8 Melt Furnace 8M1 (E) 100 ton Refractory –Fastener Details	
A-189730-WK	70 Ton Melting Furnace 1M2 Refractories Furnace Proper – Fastener Details	
A-189731-WK	70 Ton Melting Furnace 1M2 Refractories Furnace Proper - Refractory Bill of	
A 004070 MIK	Materials	N. O.M. N. F
A-204870-WK		No.8 Melt Furnace 8M1 (E) 8M3 (W) 100 ton Refractory –Cast
A-204871-WK		per and Lower Plan No.8 Melt Furnace 8M1 (E) 8M3 (W) 100 ton Refractory –Cast
A-2048/ 1-VVK		ctions and Details
A-204872-WK	EMC Casting Unit No.8 Melt Furnace 8M1 (E) 8M3 (W) 100 ton Refractory –Cast Wall Rebuild - Anchor Location Arrangement	
A-204873-WK	EMC Casting Unit No.8 Melt Furnace 8M1 (E) 8M3 (W) 100 ton Refractory –Cast Wall Rebuild - Anchor Fastener Details and Bill of Materials	
ADDITONAL STANDA		
A.W.S code D1.1	Most recent	American Welding Society welding specification
ASTM, ASME and ANSI standards for pipe, fittings, flanges, bolts and nuts	Most recent	General specifications for the standard pipe, pipe fittings, nuts and bolts



OSHA 19.26	Most recent	Safety and Health Regulations for Construction
OSHA 1910.147	Most recent	Lockout/Tagout/Tryout
NFPA 54	2012	National Fuel Gas Code
NFPA 79	2012	Electrical Standard for Industrial Machinery
NFPA 86	2011	Standard for Ovens and Furnaces
SUPPLEMENTAL DOCUMENTS		
	PDF format	Warrick training schedule appendix E, CP-011
	PDF format	Warrick construction site conditions CP-005
	Power Point	Level 2 Chlorine
	PDF format	Contracted hours compilation form CP-013
-	PDF format	Contractor audit form
	Power Point Doc	TPM Design Checklist for Engineers
-	PDF format	Open-Top Galbreath Hopper R1254-2
	PDF format	PACTEC Collection Bag (VP1448863)
	PDF format	A-147262-WK Baghouse Discharge Assembly
	PDF format	Test Ports – Monorail Setup
	PDF format	Test Port – Platform Spec

G. REFERENCE DRAWING LIST

Drawing No.	Dated	Title
SK-171013-PAI1	Latest Rev.	Layout of building where Furnace will be installed (Includes truck paths & Scrap Bin Locations)
SK-171013-PAI2	Latest Rev.	Construction Vehicle Access, Trailer Locations, Laydown Yard and Construction Area - Map
A-042210-PE	Latest Rev.	Building Steel (Cols 1 thru 21)
A-042211	Latest Rev.	Building Steel (Cols 21 thru 29)
A-042294	Latest Rev.	Original foundations installed for casting complexes. This area is now a flat slab at elevation of 396'-0"



A-186129-WK

6/2002

Melting and Casting Complex No.5 – 5EH Misc. Steel Sections and Details

H. SERVICE PROVIDERS LIST

The following is a list of current contractors approved to operate at the Alcoa Warrick facility. The contractor is required to schedule these contracted services where required.

NIX -812-897-4381

This company is already on site at Alcoa Warrick and is the required contractor to use for these services. Contractor is to include the cost of these services in their quote.

Port-O-Johns
Portable hand wash stations

EVERGREEN AIR MONITORING- 502-968-0507

Contractor is on-site if their services are needed.

WASTE MANGEMENT by HERITAGE—Jason Temme - 812-853-4103, mobile 812-306-8241

This company is already on site at Alcoa Warrick and is the required contractor to use for these services.

Waste Disposal

JOE BEARD - 812-423-6616

This company is already on site at Alcoa Warrick and is an approved contractor to use for these services. Contractor is to include the cost of these services in quote.

Vacuuming Clean up

ELITE ENVIRONMENTAL SERVICES: - Joe Beard - 812-424-7441, mobile 270-499-4366

This company is already on site at Alcoa Warrick and is an approved contractor to use for these services.

Abatement of asbestos, lead, coated materials

Alcoa will write a separate contract to Elite for abatement where needed. Contractor is to clarify what, where, and when abatement is needed. All building steel is coated and needs abatement.

STERLING BOILER AND MECHANICAL INC: -

Gerald Bradley - 812-853-7025 mobile 812-305-6755 gbradley@sterlingboiler.com

This company is already on site at Alcoa Warrick and is a trained contractor to use for removal of chrome contaminated waste. The contractor must coordinate the timing for these services.

PRO-ALIGN INC.:

Grant Eiler - 812-480-0658 cell



This company is already on site at Alcoa Warrick and is the required contractor to use for these services. The contractor must coordinate the timing for these services. Pro-Align will work for the refractory contractor.

Optical alignment, anchor bolt verification and other survey work

Trockman & Sons: - 812-425-5271

This company has a contract with Alcoa Warrick and is the required contractor to use for disposal of scrap steel. Contractor must contact Trockman to schedule for movement of trailers for scrap steel disposal.

I. WARRICK CONTRACTOR SITE CONDITIONS

See the included: ALCOA INC. Warrick Operations--Contractor, Subcontractor, and Contracted Services Site Conditions

Revision date: 2007/09/20 Document ID number: CP-005

J. TRAINING FOR CONTRACTOR EMPLOYEES AT ALCOA

Contractor and their Sub-Contractor(s) must ensure their employees have the required work specific training certification and are current on their training. Examples of job specific training / certifications required could be, but not limited to, OSHA, Lock/Tag/Try, Confined Space Entry, Fall Control, Mobile Equipment, Respirator User, Respirator fit testing, Hot Works, Vehicle certifications etc. Only certified and trained employees can perform the respective job tasks.

NOTE: Current "ARSC" Orientation and Card is required for all contractor / sub-contractor personnel working on site. This can be scheduled with the local university at the following website: http://www.usi.edu/tsisc/ or we accept ARSC cards from other locations around the U.S. Locations of other ARSC around the Nation: http://arsc.net/



K. APPENDIX

APPENDIX A

ELECTRICAL SPECIFICATION MA4WGS01-E-001

MOTOR SPECIFICATION

Revision 1

Type: Squirrel Cage Induction

Preferred Vendor: Reliance

Voltage: 460 VAC

Phases:

Frequency: 60 Hertz

Synchronous Speed: 1800 RPM (Unless specifically approved by Owner)

3

Service Factor: 1.15 (Do not work into Service Factor on a routine basis)

Enclosure: TEFC or TENV (Unless specifically approved by Owner)

Note: A "Severe Duty" motor will be used whenever the motor is to be exposed

to high temperatures or high contamination levels.

Frame Size: Standard NEMA Frame Sizes are preferred.

Coupling: Coupling must be readily available in the United States.

Bearings: Anti-friction, regreasable.

Temperature Rise: Class B
Insulation Class: Class F

Design: Motor design shall be appropriate for the load being driven. Motors specifically

designed for Variable Frequency Drive Service shall be used when powered by

Variable Frequency Drives.

Efficiency: Motors must be "Premium Efficiency" and comply with the United States of

America "Energy Independence and Security Act (EISA) of 2007". See NEMA MG-1 Table 12-12. All motors, pumps, gearboxes, etc. shall be sized to suit the

application while maximizing electrical efficiency and power factor.

Embedded RTD's: All motors greater than or equal to 100 Horsepower shall be equipped with one

100 Ohm Platinum RTD embedded in the motor stator winding.

Less than 1 HP, the following voltage is permissible with owner's specific approval

Voltage: 120 VAC

Phases: 1

Frequency: 60 Hertz



APPENDIX B

ELECTRICAL SPECIFICATION MA4WGS01-E-002

MOTOR CONTROL SPECIFICATION

Revision 1

SINGLE-SPEED APPLICATIONS (REVERSING OR NON-REVERSING) LESS THAN 125 HP

Starter Type:

Full Voltage, Across-the-Line, NEMA Style. IEC Style Starters are NOT

ACCEPTABLE.

Preferred Manufacturer: Allen Bradley. Other vendors may be used pending approval by owner.

Starter Mounting: Starters to be housed in Motor Control Center in individual buckets.

MCC Enclosure to be rated NEMA 12 (IP54). To eliminate the need to wear Category 1 or higher Personal Protective Equipment, **NO** 460 VAC components shall be mounted in enclosures that house PLC's, relays and other Control Equipment that will routinely be tested during

maintenance troubleshooting.

Branch Circuit Protection: Fusible Disconnect with Current Limiting Fuses is preferred. Other

Branch Circuit Protective Devices are acceptable if they provide Type 2 Protection. That is, no damage will occur in the Motor, Starter or Branch Circuit in the event of a Short Circuit in the Branch Circuit. Assume

available Short Circuit is 65 KA.

Starter Sizing Criteria:

Per NEMA Standards.

Rated Voltage:

600 VAC minimum

Applied Voltage:

480 VAC

Phases:

3

Frequency:

60 Hertz

Coil Voltage:

120 VAC is preferred, but 24 VDC is acceptable.

Auxiliary Contacts:

Two (2) Normally Open rated for 24 VDC or 120 VAC switching.

Overload Protection:

Electronic Overload with Phase Loss Protection, Class 10 Protection, Ambient Compensated and Manual Reset is preferred. Others may be

used with prior owner approval.



APPENDIX C

SPECIFICATION FOR 85% ALUMINA ROOF ANCHORS

Material

85% Alumina, phos-bonded, pressed and burned anchor brick

Dimensional Tolerances

Attachment end Thickness +0.03"/ -0.09"
Width +0.06"/ -0.10"
Length Nominal +/- 0.05"

Non-destructive Testing

Fired Bulk Density Nominal +/- 1.5%

Porosity Nominal +/- 1.5%

Destructive Testing

Tensile Strength Pull to failure with approved clip

Approval

New anchor vendors must first have their anchors pass the Alcoa Alkali Resistance Test. Then with the first order, two random anchors from each mix batch will be dimensionally, non-destructively and destructively tested and the results reported to the plant contact prior to shipping the anchors. All test results must be within tolerance.



APPENDIX_D

SPECIFICATIONS FOR PRE-CAST REFRACTORY SHAPES (NOT BIG BLOCK)

DRAWINGS

PRE-CAST SHAPES SHALL BE MANUFACTURED PER THE <u>ALCOA</u> SUPPLIED DRAWING. IF THE VENDOR IS TO SUPPLY DRAWINGS AS PART OF THE ORDER, THEN THE DRAWINGS SHALL BE SUPPLIED WITH ALCOA PLANT SPECIFIC TITLE BLOCK AND BORDERS PER THE PLANT'S COMPUTER AIDED DRAFTING STANDARDS AND ARE THE PROPERTY OF ALCOA.

DIMENSIONAL TOLERANCES

HEIGHT ± 1/8" FROM BLUE PRINT DIMENSION

WIDTH ± 1/8" FROM BLUE PRINT DIMENSION

LENGTH + 1/8" FROM BLUE PRINT DIMENSION

SURFACE QUALITY

ALL PROTRUSIONS GREATER THAN 1/32" HIGH SHALL BE ELIMINATED. MINOR INDENTION'S ARE ALLOWED.

THE SHAPE'S HOT FACE SHALL BE STRUCTURALLY SOUND. REFRACTORY GRAINS SHALL BE HOMOGENEOUSLY MIXED WITHIN THE HOT FACE REGION.

FLASHING OR FINS SHALL BE NO GREATER THAN 1/32" IN HEIGHT ON ANY SURFACE.

CRACKS - GENERAL GUIDE LINES

CRACKS HAIRLINE TO 1/16" WIDE THAT CROSS ANY SURFACE AND COVER THE ENTIRE LENGTH OR WIDTH OF ANY FACE OF THE SHAPE ARE UNACCEPTABLE.

CRACKS 1/16" WIDE OR GREATER AND MANUFACTURING LAMINATIONS ARE UNACCEPTABLE

DRYOUT

SHAPES SHALL BE DRIED OUT PER THE REFRACTORY SUPPLIER'S RECOMMENDATION TO A MINIMUM OF 1500° F SURFACE TEMPERATURE UNLESS OTHERWISE SPECIFIED BY THE PLANT.

SHAPES WITH EXTERNAL STEEL MOUNTING HARDWARE (LIKE A CHANNEL OR I-BEAM) TO BE DRIED TO 800F INSTEAD OF 1500F.

THE VENDOR SHALL SUPPLY ALCOA THE FOLLOWING DOCUMENTATION UPON REQUEST:

- DRYOUT SCHEDULE PRIOR TO ACTUAL DRYOUT
- DOCUMENTATION OF ACTUAL KILN TEMPERATUR FOR DRYOUT OF SHAPE
- DOCUMENTATION OF KILN PROCESS/PROCEDURE CAPABILITY
- DOCUMENTATION OF LAST CALIBRATION OF THE KILNS

ANCHORS

ALL ANCHORS SHALL COMPLY WITH ALCOA'S METALLIC REFRACTORY ANCHOR SPECIFICATIONS.

STAINLESS STEEL WIRE



STAINLESS STEEL WIRE SHALL BE RIBTEC 446 UNLESS OTHERWISE SPECIFIED BY THE PLANT.

INSPECTION

ALCOA HAS THE OPTION TO INSPECT REFRACTORY SHAPES AT THE VENDOR'S FACILITY PRIOR TO SHIPMENT. VENDOR SHALL CONTACT REQUISITION WRITER A MINIMUM OF 1 WEEK PRIOR TO SHIPMENT TO SCHEDULE THE INSPECTION.



APPENDIX E

ALCOA - ENGINEERING STANDARD

WORKMANSHIP AND INSTALLATION STANDARD FOR LARGE BLOCK REFRACTORY LININGS AND BACKUP INSULATION MATERIALS

1. GENERAL

This is the workmanship standard for the installation of a large block refractory lining and insulation in an aluminum holding and/or melting furnace. It applies to work performed by the installer's personnel. The "installer" may be plant forces or outside contractor forces, but if a contractor does the work, "installer" and "contractor" shall be considered as one and the same.

2. CONTRACTOR'S COMPETENCE

- 2.1 Competent supervision and labor shall be furnished to install the refractory materials specified for this job in a manner satisfactory to the particular requirements herein described.
- 2.2 The supervisor directing work under this standard shall have had actual experience in installing refractories in aluminum melting furnaces.
- 2.3 The Contractor's bid on these specifications shall include a history of the past five years of his company's and his supervisor's experience on aluminum melting furnaces in the date, number of furnaces and furnace locations. The proposed supervisor's name shall accompany the bid.

3. INSPECTION

- 3.1 Sub-standard work or work judged by the Owner's Engineer to be of inferior quality shall be removed and replaced at the request of the Owner's Engineer at no additional cost to the Owner.
- 3.2 Those workmen who, in the opinion of either the Contractor'ssupervisor or the Owner's Engineer, persist in the performance of sub-standard work shall be replaced.
- 3.3 Care shall be exercised in storing, handling or moving large refractory blocks to minimize damage or loss. Any loss shall be at contractor's expense.
- 3.4 All shipments of material shall be inspected for loss, damage or shortage prior to starting installation of refractory, and this shall promptly be reported to the Owner's Engineer so that replacement material can be obtained.
- 3.5 The owner's engineer will periodically inspect the block refractory installation while in progress.

4. WORKMANSHIP

4.1 Block Refractory Large refractory block have been made to close tolerances in order to reduce joint thickness and to provide accurate "building blocks" for furnace construction. It shall be the contractor's responsibility to check the dimensions of the blocks to insure they conform to the drawings. See Alcoa's "Specifications for Big Block Refractory" for tolerances.

<u>4.2 Lower wall insulation</u> - Insulate the lowerwall area of the furnace to a height equal to the top of the lower wall block as per the drawings.

After the insulation has been installed, cover the surface with either aluminum foil or 1/8 inch fiberfrax paper using insulating block adhesive. The lower area where the starter course is to be cast must be covered with foil or approved coating to prevent absorption of water from the castable.

4.3 Starter Course - The starter course is to be formed and cast as per drawings and the Owner's Engineers instructions. Extreme care is to be used to insure the starter course is level, true and smooth in



order to set the lower wall blocks. Errors in the starter course will be multiplied as courses of block are installed. It shall be this contractor's responsibility to correct errors in the starter course by grinding, chipping, filling, etc. to insure an accurate base on which to set blocks.

- <u>4.4 Special Equipment</u> A small fork truck, preferably electric, is required to handle and install blocks within the furnace. The following specification is given only as a guideline with actual requirements to be discussed with the owner's engineer due to variations in furnace size and block weights:
- a) 4000 to 6000 lb. capacity cushion tire electric walkie or rider stacker fork truck.
- b) 24 inch load center capacity.
- c) Minimum lift height 11 to 12 feet.
- d) Carriage to allow forks to open to a maximum opening of 37 inches outside to outside dimension.
- e) Fork length 16 to 18 inches with square cut ends to allow the block to set against the mast and still allow placement.

f) Carriage to be equipped with side shifter having approximately 6-inch lateral movement, if available.

- g) Mast to have both forward and backward tilt capability of approximately 8 degrees.
- <u>4.5 Lower walls</u> The corner blocks, if part of the design, shall be placed first to provide a vertical and horizontal base from which the sidewalls and back wall are built. The procedure for installation is as follows:
- 1) Place corner block in position on starter course not mortared.
- 2) Check block faces for plumb and top for level.

3) If shimming is required, this is to be done using round steel flat washers of various thickness or equal.

4) Remove block, shim and replace. Check for level and plumb.

Repeat as necessary.

5) After proper plumb and level has been obtained, remove block, mortar starter course, carefully replace shims and reset block. Check to insure block is tight against insulation and is plumb and level. For the back wall, stretch a string line between the tops of the corner blocks. The line is used to establish the elevation of the back wall blocks. After a block has been set unmortared, it is to be checked for level and plumb and shimmed as required. Also inspect the back of the block to determine how much of a void there is to the insulation. Bowing in the steel shell, which must be filled with moldable during the final placement, causes the void. The block is then removed and both the mating face with the adjacent block and the starter course is to be mortared. Moldable is applied to the back of the block suitable to fill the void to the insulation. The block is then reset and checked for plumb, level and tightness to the insulation and the adjacent block. The side shifter, pry bar or a port-a-power with a kicker board can be used to push blocks together to insure full, tight joints of 1/16 to 1/8 inch thickness nominal with a maximum thickness not to exceed 1/4 inch. DO NOT jack directly against the block surface. A piece of wood (approx. 1 x 4 or equal) shall be used between the jack and the block. This method is also used to compress excess moldable out from behind the block for final positioning.

For the sidewall, place the block closest to the door in its approximate position. Check for plumb and level and shim as required. Leave this block set unmortared. Stretch a string line between the top of the corner block and the top of the end sidewall block. Again, this line is used to establish the top elevation of the blocks. Place the sidewall blocks starting at the corner block working toward the door end using the same procedure as described for the back wall blocks above.



When the next to last sidewall block is to be placed, remove the end block and finish the wall using the above procedures. Repeat this procedure for the opposite sidewall.

The fork truck slots in the bottom of the blocks are to now be filled with molten metal contact quality plastic as per the drawings and the Bill of Materials. The key slots between blocks and the voids between blocks where tap holes, drain holes or spaces where blocks are not used can now be filled. These voids shall be filled as per the drawings, Bill of Materials and the Owner's Engineer's instructions.

- <u>4.6 Upper Wall Insulation</u> Insulate the remaining upper wall areas of the furnace as per the drawings. Remove all loose particles of insulation on top of the lower wall blocks to provide a clean base for the next row of blocks.
- 4.8 Upper walls. The upper sidewall blocks are to be placed using the same procedures as in placing the lower sidewall and bellyband blocks. A small portable scaffold shall be used to assist in providing adequate access to the upper wall block rows for shimming and mortaring the blocks.

The sidewall blocks are typically placed before placing the back wall blocks and flue side blocks, if used. Use upper wall quality plastic per the drawings and the Owner's Engineer's instructions to fill the fork slots. Any voids between blocks are to be filled as per the drawings, Bill of Materials and the Owner's Engineer's instructions.

NOTE: Some block furnace designs may require installation of back wall bellyband and upper wall blocks before the sidewall blocks. This standard is to be used as a guide with final installation instructions per the drawings and the Owner's Engineer.



APPENDIX F

ALCOA - ENGINEERING STANDARD

WORKMANSHIP AND INSTALLATION STANDARD FOR BRICK REFRACTORY LINING IN ALUMINUM MELTING AND HOLDING FURNACES

1. GENERAL

This is the Workmanship and Installation Standard for the placement of a refractory brick lining in aluminum melting and holding furnaces. It applies to work performed by the Installer's personnel. The "Installer" may be plant forces or outside contractor forces, but if a Contractor does the work, "Installer" and "Contractor" shall be considered as one and the same.

2. QUALIFIED CONTRACTOR'S COMPETENCE

- 2.1 Competent supervision and labor shall be furnished to install the refractory materials specified for this job in a manner satisfactory to the particular requirements herein described.
- 2.2 The supervisor directing work under this standard shall have had actual experience in installing refractories in aluminum melting and holding furnaces.
- 2.3 The Contractor's bid on these specifications shall include a history of the past five years of his company's and his supervisor's experience on aluminum melting and holding furnaces including the time, number of furnaces, type of furnace, and furnace locations. The proposed supervisor's name shall accompany the bid.

3. INSPECTION

- 3.1 Sub-standard work or work judged by the Owner's Engineer to be of inferior quality shall be removed and replaced at the request of the Owner's Engineer at no additional cost in either labor or material to the Owner.
- 3.2 Those personnel who, in the opinion of either the Contractor's supervisor or the Owner's Engineer, persist in the performance of sub-standard work shall be replaced.
- 3.3 All shipments of material shall be inspected for loss, damage or shortage prior to starting installation of the refractory, and this shall promptly be reported to the Owner's Engineer so that replacement material can be obtained.
- 3.4 Care shall be exercised in storing, handling, or moving brick refractory to minimize damage or loss. Once the material is in possession of the Contractor, any loss shall be at the Contractor's expense.
- 3.5 The Owner's Engineer will periodically remove brick to check bonded joints. When air bubbles or unsatisfactory work are found, the brickwork involved shall be removed and replaced correctly.

4. WORKMANSHIP

- 4.1 Brick Details and Drawings. Note that detail drawings are included to show placement of brick in all sections of the furnace, and that brick courses are numbered to locate details and starter courses and sectioned to indicate the specification of brick to be used.
- 4.2 Special Brick Shapes. Where the standard splits, soaps and special shapes do not adequately fulfill requirements for coursing outs, the required shapes shall be cut from surplus straights on the job. All brick and shapes will be specified to close dimensions and all refractory sections designated to minimize the amount of brick cutting. However, because of size variation of the brick, it may be necessary to cut some brick. Allow for at least one full cut in each course of each side wall and back wall.
- 4.3 Cutting Brick. High alumina, silicon carbide and zircon refractory shapes shall be cut as required to complete the installation. These materials can be wet cut on regular brick saws using diamond blades. Saw blade specifications shall be checked to determine the number of cuts per blade that can be expected for the various refractory materials. The usual masonry brick saw blades are satisfactory for cutting regular fireclay brick and shapes. Because of dust problems, dry cutting of brick shall not be permitted unless approved by Owner's Engineer.
- 4.4 Brick Dampening. To insure mortar adherence to nitride-bonded silicon carbide brick, wipe off and then dampen the brick by submerging the face to be mortared in room-temperature water.



4.5 Mortar Metering Trowel. Butter the mortar on all brick with a mortar metering trowel. Such a trowel applies a metered amount of mortar, thus insuring joints that are uniform in thickness and free of air bubbles or voids. A metering trowel is made from a normal 9-inch or larger trowel with one edge sawtoothed or serrated. Mortar is applied using this edge. The other edge is straight for use in clean off, etc. 4.6 Mortar Mixing. Supply and use a slow speed (approximately 300 RPM) power mixer to obtain the proper consistency in mixing all mortar. A slow speed is required to prevent air entrainment. Foamy mortar will be considered unsatisfactory and will be rejected by Owner's Engineer. The mortar shall be mixed according to the manufacturer's instructions. The mortar shall be thoroughly mixed so that there will be no lumps or coarse particles that would prevent a thin full joint. It shall be of such consistency that it will not run or flow out of the joints of its own accord, but sufficiently thin so that it will flow and form a full joint when the brick is rubbed and tapped into place. If too thick, the mortar will not thoroughly bond to the brick already in place. If too thin, the mortar will not have sufficient body to obtain a full joint, because there is a tendency for the mortar to drain and leave a void at the top of the joint. A thoroughly mixed mortar of the consistency of a heavy cream shall be obtained. The Owner's Engineer may reject unsatisfactory joints.

4.7 Brick Placement. Place all brick with care, and use special care when placing all refractory brick and shapes below the metal line in order to insure that the joints are tight and completely filled with mortar.

A facing of mortar shall be applied to a brick surface that will contact refractory concrete. In order to eliminate air bubbles in the joint, the mortar must be "buttered" on the brick using the special saw-tooth or mortar metering trowel as described in Section 4.5. Brick shall then be forcibly rubbed into place and tapped firmly to a tight fit with a brick hammer. Each brick shall be rubbed back and forth a few times to seat it properly and to spread the mortar. The excess mortar that squeezes from the joint shall be removed with the straight edge of the trowel. The mortar joint thickness shall not exceed 1/16 inch.

When a brick is too large or too heavy to hold in one hand to butter (for example: 13-1/2x6x3 brick), it will be satisfactory to use the mortar-metering trowel to lay a bed of mortar on the brick course already placed. Then, place the brick on the mortared bed, rub forcibly into place, and tap firmly to a tight joint.

In coursing out, the last row of brick shall be cut as required to fit snugly in place so that "chinking" or pouring mortar into the joints is not necessary. However, the last row of brick shall not be forced into place because this would disturb the bond of previously laid brick.

The use of a jack or wedge (Porta-Power, etc.) to enlarge an opening to avoid a cut shall not be permitted.

When it becomes necessary during installation to remove brick below the metal line, all mortar, which can possibly be removed from the exposed surfaces of the bare brick, shall be scraped away immediately. Do not use the removed brick again until it has been cleaned with water and thoroughly dried.

When a brick, which has been set or placed, is disturbed or moved so that the bond that has been formed is broken, it shall be removed and replaced as described above. Brick with chipped edges or broken corners must be reserved for use in the least critical areas of the furnace.

NOTE: This standard is to be used as a guide with final installation instructions per the drawings and the Owner's Engineer.



APPENDIX G

ALCOA - ENGINEERING STANDARD

WORKMANSHIP AND INSTALLATION STANDARD FOR CASTABLE REFRACTORY LINING IN ALUMINUM MELTING AND HOLDING FURNACES

1. GENERAL

This is the Workmanship and Installation Standard for the placement of a refractory castable lining in aluminum melting and holding furnaces. It applies to work performed by the Installer's personnel. The "Installer" may be plant forces or outside contractor forces, but if the work is done by a Contractor, "Installer" and "Contractor" shall be considered as one and the same.

2. QUALIFIED CONTRACTOR'S COMPETENCE

- **2.1** Competent supervision and labor shall be furnished to install the refractory materials specified for this job in a manner satisfactory to the particular requirements herein described.
- 2.2 The supervisor directing work under this standard shall have had actual experience in installing refractories in aluminum melting furnaces.
- 2.3 The Contractor's bid on these specifications shall include a history of the past five years of his company's and his supervisor's experience on aluminum melting furnaces including the time, number of furnaces, type of furnace and furnace locations. The proposed supervisor's name shall accompany the bid.

3. INSPECTION

- **3.1** Sub-standard work or work judged by the Owner's Engineer to be of inferior quality shall be removed and replaced at the request of the Owner's Engineer at no additional cost in either labor or material to the Owner.
- **3.2** Those personnel who, in the opinion of either the Contractor's supervisor or the Owner's Engineer, persist in the performance of sub-standard work shall be replaced.
- **3.3** All shipments of material shall be inspected for loss, damage or shortage prior to starting installation of refractory, and this shall promptly be reported to the Owner's Engineer so that replacement material can be obtained.
- **3.4** Care shall be exercised in storing, handling, or moving castable refractory to minimize damage or loss. Once the material is in the possession of the Contractor, any loss shall be at the Contractor's expense.
- **3.5** The Owner's Engineer will periodically inspect castable refractory installation while in progress. This inspection includes but is not limited to water addition, mix time, mix temperature, vibration time and intensity and installation technique.

4. STORAGE & HANDLING

4.1 Castable refractory is extremely sensitive to moisture. The Contractor will assure that all refractory materials (including mortar, insulation, etc.) will be stored "in the dry". All handling and movement of the material from storage to the job site will also be "in the dry". Once the material is in the possession of the Contractor, any material damaged by moisture shall be at the Contractor's expense.

Castable refractory is also extremely sensitive to temperature. The Contractor will assure that all castable refractory material is maintained between 50 and 80 degrees F. The Contractor will contact the Owner's Engineer and the refractory supplier if these temperature conditions cannot be maintained. Once the material is in the possession of the Contractor, any material damaged by temperature shall be replaced at the Contractor's expense.

4.2 Castable refractory is usually obtained either in 50/100 pound bags, palletized (3000 lb.) or in 1000/1500 lb. bulk bags, double stacked and plastic wrapped on pallets. These bags can easily be punctured with forktruck forks or overturned while handling. Extreme care shall be exercised while handling and transporting to minimize damage. Once the material is in the possession of the Contractor, any loss of refractory because of handling damage will be at the Contractor's expense.



5. CASTABLE REFRACTORY - GENERAL

Castable refractories are available in a wide variety of base materials and typically consist of a refractory aggregate, special purpose additives and a cement binder (typically calcium-aluminate cement). The bonding systems used are often used to classify the types of castables into four categories: conventional, low-cement, ultra-low cement and cement free castables. The castables normally used for the working linings in ALCOA furnaces are typically in the low-cement and ultra-low cement families. These refractories are extremely sensitive to temperature, water additions, mixer type utilized and mix time. Therefore, extreme care must be used in the preparation and placement of castable refractories. It is essential that the Manufacturer of each refractory material be contacted for the recommended preparation and placement requirements. Attached at the end of this document is a form that should be used to record the essential parameters of the refractory preparation to document that the manufacturer's recommendations were followed. The Owner's Engineer will audit the data collection and retain these records as part of the project file.

6. EQUIPMENT

****NOTE****

ALL TOOLS AND EQUIPMENT UTILIZED IN THE MIXING, HANDLING AND PLACING OF CASTABLE REFRACTORY MUST BE CLEAN AND FREE FROM ANY CONTAMINATION ESPECIALLY PRODUCTS THAT MAY HAVE CONTAINED PORTLAND CEMENT. CONTAMINATION MAY CAUSE FLASH SETTING OR REDUCE THE FINAL STRENGTH OF THE REFRACTORY.

6.1 MIXERS: There are several styles of refractory mixers that are available for use. Contact the refractory vendors to determine which is best to use with their material and application. Mortar or concrete mixers shall not be used because they are not constructed to handle the aggregate size, density or stiffness of today's castables. The refractory mixer should be oversized for the batch being mixed. Example: Using 1500 lb. bulk bags, the mixer should have a capacity of 2500 to 3000 lbs.

The mixers should be equipped with water metering capability, either an attached meter or a remote pump/meter assembly. This meter must be capable of accurately measuring to 0.1 gal. and must be "in control and capable". If the meter is on a rental unit, it shall be verified for control and capability prior to mixing the first batch. If the meter is on the Contractor's unit, verification data as to the unit's control and capability may be acceptable.

6.2 PUMPS There are several styles of refractory pumps that are available for use. Contact the refractory vendors to determine which is best to use with their material and application. Currently, ALCOA has used three different manufacturers of pumps for refractory placement. These pumps are 4" or 5" diameter swing valve type; Morgan Mustang 30, Allentown, and Putzmister. When installing upper wall or roof refractory, any of these are acceptable. When pumping the high density, metal resistant, low cement castable it is highly recommended that a 5" discharge pump with a minimum of 30 horsepower diesel (or electric equivalent) drive unit be employed. The discharge piping from the pump to the furnace forms shall consist of as much steel pipe as possible to reduce friction loss, especially the vertical lifts. **6.3 FORMS** All form work must be of substantial design and capable of containing refractory material with densities in excess of 210 pounds per cubic foot and heights of 5 to 7 feet. The surface of the forms that contact the refractory will be clean and coated with a vegetable oil or other release agent to eliminate sticking.

7. INSTALLATION TECHNIQUE

Castable refractory is generally placed utilizing three distinct techniques; damp ramming, casting and pumping.

7.1 DAMP RAMMING: This method is normally used for the installation of subhearth refractory but, can under extraordinary conditions (high or ultra-high purity furnaces) be used for other locations. The castable is mixed with very low water content. When mixed properly, the material will have sheen on the surface and with considerable effort can be formed into a crumbly ball. Ram or tamp with a 6" diameter rammer connected to 80 psi. air. The ramming technique is similar to ramming plastic as described in Engineering Standard on Ramming. Refractory materials that are installed by damp ramming are



generally of higher cement content. Care must be taken that the material does not begin its heat of hydration before the job is complete. If the job cannot be completed continuously, form up the end of the ramming and install a key at the vertical center of the material. This method will yield a subhearth that has considerably less water and will be somewhat denser than if it were cast. When installation is complete and the material begins to steam, either cover with wet burlap and mist with water to keep wet until steaming stops or spray on a sealer.

7.2 CASTING: There are materials within this classification that can be used in all furnace, filter box, troughing and ingot refractory applications. Castable refractory is divided into four different categories based on total lime (CaO) and the mixing and handling characteristics are different for each of these. The total lime content will appear as % CaO on the refractory vendor's data sheet or on the MSDS sheets for the individual product.

Temperature is very critical to all classifications of castable. NEVER cast when the ambient temperature is below 32 degrees as the water will freeze and weaken the refractory. If the temperature is below 50 F. either cover the material and heat and/or use warm water in mixing. Temperatures above 80 F. will require icing the water to reduce the mix temperature.

- 7.2.1REGULAR This category of refractory has a total lime (CaO) content of greater than 2.5%. Because of the high lime content and its inherent variability, the water required must be varied to maintain consistent batch to batch mixes. Add 3/4 of the required water at the start of the batch and slowly add water to get the desired consistency. Attempt to stay as close as possible to the low end of the vendor recommended water level, but do not go below. The mix time must be in the range as specified by the manufacturer. When placing regular cement material with large aggregate internal vibration should be minimized because of possible segregation.
- 7.2.2LOW CEMENT CASTABLES This category of refractory has a total lime (CaO) content of greater than 1.0 % and less than 2.5%. The variability of these products will be much less than the regular cement castables and will require less jockeying of the water additions. Once the mixer has stabilized, add the low limit of the water and only add if mixture is not consistent with the other batches. Attempt to stay as close as possible to the low end of the vendor recommended water range, but do not go below or hydration may not occur. Mixing time is more critical. After the refractory and water are added to the mixer is when the time starts and the normal range should not be shortened or extended. Follow the manufacturer's recommendation as to water addition, mix time and vibration. Vibration will be required to move the material to properly fill the forms and to knit one batch with the previous batch. Over vibration may occur, however, these products are not as vibration sensitive as the above materials.
- 7.2.3ULTRA LOW CEMENT CASTABLES This category of refractory has a total lime (CaO) content of greater than 0.2% and less than 1.0%. The variability of these products is minimal. These products are extremely sensitive to water additions and mixing time. The mixing time is generally much longer than the above materials (6 to 9 minutes). With the correct water addition these refractories will look very dry until about 4-1/2 to 5 minutes mixing when a sheen will appear on the surface. Continued mixing, to the recommended time will result in a good ball-in-hand consistence. Placement of this type of material is the same as with the low cement castables.
- 7.2.4NO CEMENT CASTABLES This category of refractory has a total lime (CaO) content of less than 0.2%. These products use a chemical reaction to bond the material other than cement. It is critical that the manufacturer's recommendations be followed for proper mixing and placement.
- **7.3** PUMPING Pumping is generally used for large installation jobs or with furnaces with limited access. The pumps and their set-up are described in section 6.2 of this standard. Because of the volume of refractory that will be placed, it is recommended that two mixers are used to feed one pump. The refractory materials that will be placed by pumping are usually the low and ultra-low cement castables



that should be mixed as described above. Again, use the water addition and mixing times as recommended by the manufacturer. The material will appear wet as it discharges from the hose into the form, this is caused by the extra work that is put into the material by the pump and should not be cause for alarm. The pumping materials are generally of the self-leveling type so vibration requirements may be at a minimum.

7.4 INSTALLATION The installation is typically broken up into furnace sections consisting of the lower walls, upper walls, roof, and hearth. Refractory is installed in each section independently. Mix the refractory in accordance with the manufacturer's specifications and Section 7.2 of this standard. Install the refractory again in accordance with the manufacturer's specifications. Care must be taken to completely place each section to avoid the possibility of a cold joint. Vibration should be used to knit one batch to the next and shall be kept to a minimum. When casting up to a block-out, place the refractory on one side and draw it under the block-out using vibrators until the material is well up on the other side off the block-out.

8. DRY-OUT

The refractory in the furnace is ready for dry-out at this point. See the Alcoa Best Practices for Furnace Dryout.



CASTABLE REFRACTORY RECORDS

DATE:		FOR USE IN:	·
AMBIENT TEMPERATURE:	¢*		
CASTABLE:	:	MANUFACTURER: _	
CASTABLE WEIGHT:lbs.	. *		• ,
REQUIRED WATER %:	%	REQUIRED WATER (gal.):gal.
REQUIRED MIX TIME:	min.	MIXER USED:	

4572/50							1 <u>2</u> 55 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5			5 (2.55 (5.55)
						MIX TIN	E.			
	BATCH DATE	BATCH #	CASTABLE TEMP	WATER TEMP	WATER VOLUME	START TIME	END TIME	TOTAL DURATION	MIXER @PERATØR	AUDIT
1-	-	·			_		_			
2						,		l		
3								•		
4										
5					,					
6				<u>.</u>						
7			<u> </u>			,		 		
8										
9										,
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16								· .	1.	
17										
18										



APPENDIX H

ACCESSING ALCOA ENGINEERING STANDARDS -

See Attachment Separate File attached to transmittal with this document for provided Alcoa Engineering Standards (ESD).

Additional ESD documents will be provided upon request. A Porthole will be established so the Contractor can access the requested ESD documents. Please allow 2 to 3 working days for each request. Preference would be to combine all desired documents in one request.

APPENDIX I FURNACE SCRAP USAGE TABLE

Description of Scrap	Annual volume (Lbs/yr.)	Density (Lb./Ft3)	Type of Scrap
Run Around Coated Scrap	42,000,000	Coils	See comments below
Customer Toll Class 2 Coated End and Food	27,720,000	Coils	Food1
Coated Food			
Class 2 - Baled	31,188,000	25-40	Food1
Class 2 - Briquette	-	40-50	
Class 2 - Loose	5,760,000	8-12	Food1
Tab slugs - Boxed	1,800,000	8-12	Food1
Class 4 - Loose Lids	1,200,000	8-12	Food2
Class 4- Loose Lids Boxed	-	8-12	
Class 4 - Briquette	-	40-50	
Coated Food		·	
Class 2 - Briquette 5042	960,000	40-50	Food1
Total Customer Toll Class	68,628,000		

All Others Market			
Class 2 - Baled	42,000,000	35-40	Beverage



Class 2 - Briquette		40-50	
Class 2 - Loose	<u> </u>	8-12	7
Tab slugs - Boxed		8-12	4430
Class 4 - Loose Lids		8-12-	
Class 4- Loose Lids Boxed	5,520,000	8-12	E-Coat
Class 4 - Briquette	2,112,000	:40-50	. Other
Automotive			
Class - Auto Shred	18,000,000	10-12	Auto
Total Market Coated Scrap	67,632,000		
Total Incoming lbs for Coated Melter	178,260,000		
Material that will be delivered from 2EM for approximately 30 days annually			
Scalps		20-22	÷
Finishing Chips		5-7	

Notes:

- The compound liner material on the Class 4 lids is 1.04% of the total weight of each end.
- The scrap mix will vary as the market price varies. The system proposed by the Furnace Supplier (Supplier) is expected to be extremely flexible and able to support a wide mix of scrap input.

COATING WEIGHTS

*	Pusiness	Ceeling	Cig wi, mai	Ceating	Cig wt. mai	Lb coeling /100 lb Al	Lb ezgank /100 lb Al	% of all	Chamistry
an Shindhana	feed1	726	4.7	176	1.7	1.78	1.41	53%	Viryl cooxy
al automate	Food2	209	Į1	841	8	3.21	239	4%	PE
-	Beravage	190	7	156	1.3	2.33	235	Z 295	FE, scow
unimment, may both and	Ouber_	adec .		orlse		<= L8	<=1.4	218	Viryl eggsy
. Minana	f-Canta					1.1	1.2		Fpacy, acrylic

Food2 is only coated at Precoat and has the highest organic level:

E-coat® is about 20% of the total coated sheet Warrick produces; but the organic levels are very low because coating weights are low for beer.



Request For Quotation: CSM-R1 Dated 02-13-2018

L. ATTACHMENTS

ATTACHMENT A - COMPANY REQUIREMENTS

Intentionally left blank at this time.

ATTACHMENT B - PRICE

The total Contract Price agreed upon by both parties for the scope as defined in Attachment A – Company Requirements.

Complete Cost Form – Attachment B and include with your submittal.





ATTACHMENT C - TERMS AND CONDITIONS

Per Design, Build & Install T's & C's document



ATTACHMENT D: HAS BEEN DELETED FROM ORIGINAL REQ



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ATTACHMENT E: PAYMENT MILESTONES AND SCHEDULE

Payment Terms per Master Service Agreement XXXXXXX.

ופמו	Completion Date	Milestone Description	Milestone %
	9/18/2018 / TBD	Engineering for Furnace and related equipment - GA Drawings (75%) and Final Spec for Major Ordered Components	1.00%
	9/18/2018 / TBD	Engineering for Bag House and related equipment - GA Drawings (75%) and Final Spec for Major Ordered Components	1.00%
1	9/25/2018 / TBD	Down payment against Supplier Guarantee Bond	8.00%
2018	11/27/2018 / TBD	General Arrangement Drawings Approval (entire complex)	10.00%
1	10/23/2018 / TBD	Ordered major components - Steel Fabrication	2.00%
	10/23/2018 / TBD	Ordered major components - Combustion/Control	15.00%
1	10/23/2018 / TBD	Ordered major components – Bag House	10.00%
			·
2019	3/12/2019 / TBD	Ordered major components - Refractory	%00.9

02-13-2018
Dated
CSM-R1
r Quotation:
uest For
Red

4/16/2019 / TBD 8/22/2019 / Installation completion 11/22/2019 / TBD Final commissioning and acceptance			
2019 /	4/16/2019 / TBD	Goods arrival to Facility (Alcoa Warrick, IN)	20.00%
2019 /	8/22/2019 / TBD	Installation completion	12.00%
	11/22/2019 / TBD	Final commissioning and acceptance	12.00%
			5 -2.
			-7 6
			27.0



ATTACHMENT F: LIQUIDATED DAMAGES

Liquidated Damages for Delay: **ype Deliverable**

Schedule Schedule Pinal Drawings (consist of civil, mechanical, electrical, 75% of estimated number of drawing completed) by September 18, 2018 / TBD Final Drawings As-Built (consist of civil, mechanical, electrical) by November 27, 2018 / TBD Delivery DAP of Major Components (Steel Shell, Refractory, UFS, Bag House, Ductwork, etc.) by April 16, 2019 / TBD. Schedule 16, 2019 / TBD. Schedule 20, 2019 Schedule Final Acceptance Test by November 22, 2019 Schedule Overall Cap	Deliverable		Liquidated Damages - % of Contract Price	ce
Final Drawings As-Built (consist of civil, mechanical, electrical) by November 27, 2018 / TBD Delivery DAP of Major Components (Steel Shell, Refractory, UFS, Bag House, Ductwork, etc.) by April 16, 2019 / TBD. Start-up and Commissioning Completed by September 20, 2019 Final Acceptance Test by November 22, 2019 Overall Cap		consist of civil, mechanical, ated number of drawing er 18, 2018 / TBD	0.5% per (+1 week)	1%
Delivery DAP of Major Components (Steel Shell, Refractory, UFS, Bag House, Ductwork, etc.) by April 16, 2019 / TBD. Start-up and Commissioning Completed by September 20, 2019 Final Acceptance Test by November 22, 2019 Overall Cap	<u> </u>	(consist of civil, mechanical, 27, 2018 / TBD	0.5% per (+1 week)	1%
Start-up and Commissioning Completed by September 20, 2019 Final Acceptance Test by November 22, 2019 Overall Cap	Delivery DAP of Major Refractory, UFS, Bag 16, 2019 / TBD.	components (Steel Shell, ouse, Ductwork, etc.) by April	1.0% per (+1 week)	2%
Final Acceptance Test by November 22, 2019 Overall Cap	Start-up and Commis 20, 2019	ning Completed by September	1.0% per (+1 week)	2%
+-	 -	y November 22, 2019	1.0% per (+1 week)	2%
	+-			2%

Liquidated Damages for Performance:

Liquidated Damages	Within 30 days of date of seal charge, ALL listed performance	achieved. If not, 5% of Contract Price will be
Performance Guarantee	All criteria met as described in Section D. 1.3, D. 1.4, & D. 1.5) listed performance	Criteria met as described in Section D.1.6)
Criteria	Ingestion Melt Rate as fed through entire Performance refurbished chip conveyer system. (Described in Sections D.1.3, D.1.4, & D.1.5)	Temperature Recovery & Hold for bath temperatures (Described in Section D. 1.6)
Type	Performance	Performance

will be due to Company. If, after the 30 days, the days will be granted. If not met within 40 days, performance standard 5% of Contract Price not met, another 10 due to Company. 10% overall cap. Furnace pressure at sill shall maintain a positive pressure at a minimum of 0.01 inches Pass independent sampling Criteria met as described in Section D.3.8) of water column to a maximum of 0.05 inches of pressure is .025 inches of to comply with secondary MACT. water column. Target Request for Quotation: CSM-R1 Dated 02-13-2018 water column Furnace Pressure (Per description in Section D.1.1 Item 5, and physical measurement at the sill Outside Shell Temperature (Described in Section D 3.8) elevation with a hand-held manometer.) APC Lime Injected Bag House Performance | Performance Performance

Liquidated Damages not to exceed 15% of Contract Price.



ATTACHMENT G: SITE SPECIFIC CONDITIONS

Overview for New Contractor - Dated 4/11/2014



Overview for New Contractor.docx

Contractor, Subcontractor, and Contracted Site Conditions - Dated 4/10/2014



Contractor, Subcontractor, and C

CP-005 Construction Site Conditions - Dated 7/23/2009



CP-005 Construction Site Conditions.doc

CP-013 Contracted Hours Compilation Form - Dated 7/23/2009



CP-013 Contracted Hours Compilation For

Contractor Audit Form - Warrick



Contractor Audit Form.doc



ATTACHMENT H: RELEASE OF LEINS TEMPLATE

If a release of lien is required by a specific region a template will be requested by the Company prior to the release of an individual Purchase Order for the particular region.

The undersigned have furnished labor, materials, fixtures, tools, machinery, equipment or other things or have performed work or otherwise given performance under, arising out of, or in some manner connected with the Contract, an agreement supplemental to the Contract, or a subcontract made pursuant to or in connection with the performance of the Contract or an agreement supplemental to the subcontract.

It was provided, inter alia, in the Contract that Seller would, prior to the time of final payment, execute and deliver a complete release of all liens.

The undersigned for and in consideration of the premises, and of the sum of One Dollar (\$1.00) and other good and valuable considerations well and truly paid to each of us, the receipt of which is acknowledged, do fully, finally and completely release, remise, quitclaim, waive and discharge Alcoa Inc., its successors and assigns, from any and all claims, demands, liens or rights of lien, of any kind or character whatever, which the undersigned, or any of them, now have or may acquire, against any building or other structure to which the Contract relates, the additions, improvements, alterations or repairs made thereon, the ground on which the buildings or other structure is situated, or any other property or property interest owned, held, occupied, or otherwise possessed by Alcoa Inc., arising, under the law of any state, or otherwise, on account of any labor, materials, fixtures, tools, machinery, equipment or any other things furnished or any other work done or performance given under, arising out of, or in any manner connected with the Contract, any agreement supplemental to the Contract, or any subcontract made pursuant to or in connection with the performance under the Contract, or any agreement supplemental to any subcontract. This release is executed so that Alcoa Inc., its successors and assigns, will have, hold and enjoy the buildings or other structure, premises, property and property interests, free and discharged from all liens, claims and demands, which the undersigned, or any of them, now have, or may acquire, on or against the same, if these presents have not been made.

AGREED and ACCEPTED:

[Authorized signatories]



ATTACHMENT I - REFERENCE DOCUMENTS







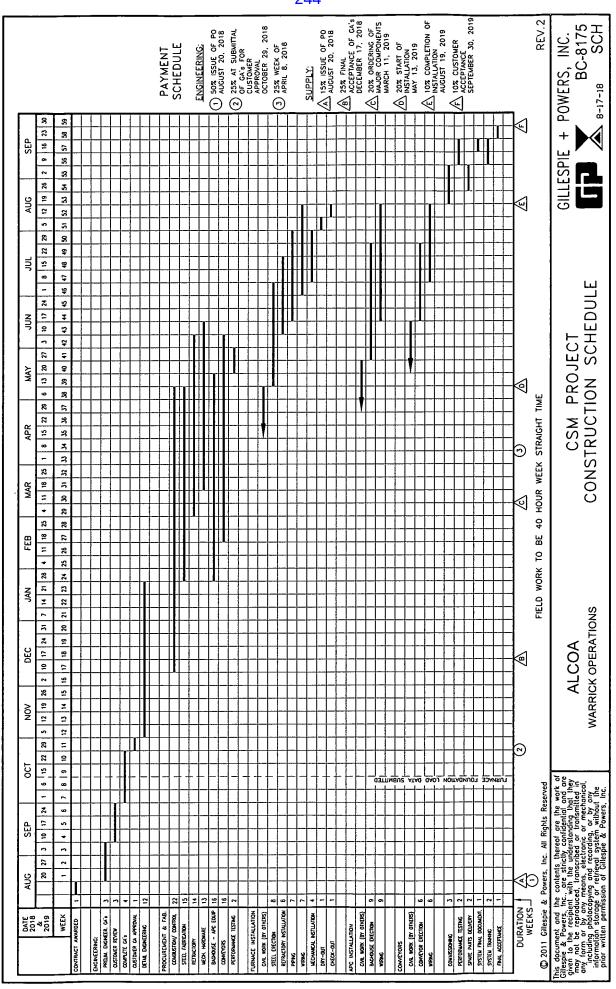














ADDENDUM LOG

PREPARED BY:	Dennis Sikora	Issue date: 02-16-2018
COPIES TO:	Alcoans:	Contractors:
	Terry Haynes, Robert Lance, Ryan	lan Marsh – Gillespie & Powers
	Slosser, Delwyn Forrest, Jake	Lee Hewitt – Mechatherm, Inc.
	Whitsitt, Steve Richardson, Stephan	Ted Phenix – GNA Alutech
	Laioie	Stephan Paech - Andritz Metal

	ADDENDUM NO. 1	DATE:2-16-2018	
	QUESTION	RESPONSE	
1	Transfer Pump System	INEST ONSE	
1a	Could you provide drawing A-193159-WK showing the transfer pump arrangement?	PDF <u>プ</u> A-193159-WK.pdf	
1b	The end of Section C.5 mentions the required quantities of primary, backup and spare pumps. We are uncertain how many pumps are required in total. Is it one primary pump with two spares for it and one backup pump with one spare for it? This would be a total of 5 pumps. Would like this verified.	Furnace manufacturer shall provide: a. 1 Primary Tapping Pump (Installed) b. 1 Backup Pump (Installed) c. 2 ea Spare Tapping Pumps with storage stands d. 1 ea. – Spare Backup Pumps with storage stand e. Total of 5 pumps & 5 storage stands	
2	Burners		
2a	The first paragraph of Section C.20 refers to "a direct-fired regenerative natural gas heating system." Section C.24 states that "Bloom Engineering Low NOx Cold Air fabricated burners shall be used in this application." Does Alcoa have a preference, regenerative burners or cold air burners? Can G&P select burner type that's best suited for its system?	Alcoa would prefer to have Low NOx Cold Air burners, but is aware that there will be a negative cost implication due to the increased size of the Baghouse System when compared to Regenerative burner systems. Please provide a recommendation for a burner system with cost comparisons between the two mentioned burner systems and associated Baghouse Systems	
3	Section G. Reference drawings		
За	 The following drawings are listed in Section G. Reference Drawing List but have not been provided: a. A-042210-PE – Building Steel (Cols 1 thru 21) b. A-042211 – Building Steel (Cols 22 thru 29) c. A-042294 – Original foundations installed for casting complexes d. A-186129-WK – Melting and Casting Complex No.5 – 5EH Misc. Steel Sections and Details 	A-042210-PE.pdf A-042211-PE.pdf A-042294-PE.pdf A-186129-WK_ref.p df	
4	Column Removal		
4a.	a note to "Remove Column B19 for skimming." Is it expected that a column will have to be removed to allow for tending the furnace? If so, is bidder to	s Alcoa produced the referenced layout with the belief that a building column along B-Column line will have to be removed to enable adequate clearance to skim the furnace. If the furnace manufacturer can produce a layout that provides the required clearance for all furnace activities	

	quote?	WITHOUT removing a building column along B-column line, then that will be a cost benefit that will be considered when evaluating the proposals. A partial list of activities that must be considered includes:
1004.0	مستحرر بيان و معاملة معاملة المعاملة ال	Clearance on the north side of the furnace for the 16 ft. wide-vehicle-access
:		Room for the conveyor system for the Vortex Feed System
		Clearance to build furnace charges and door charge the furnace
		Clearance to skim the furnace
		The Furnace Manufacturer must indicate which (if any) building column must be removed for the necessary furnace activities. Alcoa will be responsible for the Engineering and building modifications necessary to meet these demands. The cost of the necessary building modifications will be a consideration when evaluating the overall project cost for each of the Furnace Manufacturer proposals, even though this cost will NOT be include in the Furnace Manufacturer's proposal.
	ADDENDUM NO. 2	DATE:3-7-2018
	QUESTION	RESPONSE
1. 1a.	Salt Addition Can you please confirm when (at what point during the cycle) and how is the salt introduced into the furnace? For example, would it be dosed in through the vortex well along with the raw material feed or added in a lump sum option at a given time?	Alcoa's plan is to place the charge bucket on a scale that will be located within close proximity to the furnace (with cold aluminum charge in the bucket). From this a "charge weight" will be determined. Alcoa will add salt into the charge bucket at an average rate of 3% of "charge weight" Bucket will be dumped into the furnace charge door with aluminum scrap as well as salt. Only uncoated scrap will be charged into the Vortex. No salt is needed for uncoated scrap.
1b.	If it is added all at one, what is the procedure used to get the salt into the furnace?	Salt will be added with each scrap charge bucket load.
1c.	Total amount of time taken to introduce salt into the furnace if done all at once.	Salt will be added with each scrap charge bucket load.
2.	Alcoa Vortex	
2a.	What is the mass flow the Alcoa proprietary Molten metal pump is capable of producing?	Alcoa is requesting each contractor to provide a minimum and maximum flow rate and lift required for their design with their proposal. Alcoa will determine whether the Alcoa Circulating system can meet that criteria and provide a reply to each individual contractor.

Г	IVan reference drawing A 404474 W/K Hafartungtalu I		
	You reference drawing A-194174-WK. Unfortunately I	20 7 0	
2b.	cannot locate this drawing in the package provided.		
20.	Can you send that drawing to us?	A-194174-WK.PDF	
1			
	What documentation do we need to sign in addition in	The Non-Disclosure Agreement (NDA) will be sent to the	
	order to receive the documents referenced in C.2.1?	Contractor which is awarded the project contract. After	
2c.	order to receive the decaments relevanced in G.E. F.	execution of the NDA the required detailed information on	
	Ol D. J. J.	the Alcoa Vortex Bowl will be provided.	
3	Charge Bucket		
İ	Can you send us a detail of the charge container	The charge bucket(s) has not been designed. This has to	
	used by Alcoa and attached to the Glama machine?	occur concurrently with the furnace design. See below	
ŀ		drawings for two charge buckets & a "pig charging table"	
İ		designed for the Glama that Alcoa will use at #5 furnace	
		complex. Specifics for the CSM must be worked out with the	
		furnace designer.	
1		There are 1 bucket style and 1 platform style being made for	
		the MCM and 1 bucket style being made for the GAM.	
}		- MCM Bucket 33808-00-0 can carry 20,800 lbs and is	
ļ		approximately 558 ft3 inside. This drawing has a	
		door on the end but most of ours will not have the	
3a.		door.	
İ		- MCM Platform 33809-00-0 can carry 24,690 lbs and	
		has a baseplate approximately 68 ft2 that can be	
		used to stack pig on.	
ł		- GAM Platform 33738-00-0 can carry 6,200 lbs and is	
Ì		approximately 67 ft3 inside.	
		approximately or its inside.	
		33738-00-0-0-US.pd 33808-00-0-0_inch. 33809-00-0-0_inch. pdf	
	ADDENDUM NO. 3	DATE:3-19-2018	
	QUESTION	RESPONSE	
1	Salt Addition		
<u> </u>	Please provide the technical information for the types	Please refer to the MSDS sheet herein.	
	of salt to be used in the new furnace.	POF.	
10	or dark to bo adda in the new farmade.	TZ.	
1a.			
		AMCOR SDS	
ļ <u></u>		A-103-2.pdf	
2.	Scrap Charge Load Weight		
	Please confirm the normal maximum weight of any	The exact size has not been finalized and will be concurrent	
	one load of scrap to be charged on the dry hearth	with the furnace design as stated in Addendum No.2 item 3a	
	position of the furnace.	above. Examples and weight and typical bucket type were	
		given as well. The furnace size, charge size and frequency	
2a.		is to be the suppliers responsibility to provide their design	
		recommendations to meet Alcoa specification as outlined in	
		section C.2.1 - Furnace Capacity and Operation in the CSM	
		RFQ Rev.1. Dated 2-14-2018.	
		NFQ Nev. 1. Dated 2-14-2010.	
	ADDENDUM NO. 4	DATE:3-22-2018	
		<u> </u>	

1	Salt Addition	
<u>'</u>	Alcoa sharing information of Salt Technical Data	Please refer to TDS herein.
	Sheet	PAP
1a.	Officer	一
'a.		A-103-2 Technical
		Information Sheet.p
2.	Honnar Storage appositu for the vibrating feedow	
	Hopper Storage capacity for the vibrating feeder. Can you please confirm the lightest density the	
2a.	storage hopper should be sized for in order to contain	Design the volume of the Hopper Storage based upon the
20.	15,000 lbs?	density of "Scalps" at a density of 20 lb. /ft3.
3.	Furnace Charging/Tending Machines	
	Alcoa would like to explore alternative options for	Please provide equipment description and price for
3a.	furnace charging and tending equipment.	"Alternative Furnace charging & tending equipment in lieu of
		the two Glama vehicles specified in the RFQ."
	ADDENDUM NO. 5	DATE:3-26-2018
1.	Vortex Salt Feeder	
	Alcoa would like to include a Vortex Salt Feeding	
	System. This system shall be capable of feeding salt	
	into the vortex at a rate of 3% of scrap feed weight.	Do to the late addition of this manual Alasa will automat the
1a.	The Scrap Charging System and the Salt Feed	Do to the late addition of this request Alcoa will extend the
	System shall both have weigh systems and feed control systems that work through an Ethernet	Bid Submittal Date one (1) week, to APRIL 10, 2018.
	connection to the Alcoa PLC Network.	
	Connection to the Alcoa F LC Network.	
		DATED, F 00 0040
	ADDENDUM NO. 6	DATED: 5-03-2018
1.	Lime Injected Bag House	
		Alcoa wishes to stay with the specification as written for a
1. 1a.	Lime Injected Bag House Is a Reverse Air Bag House acceptable to Alcoa?	Alcoa wishes to stay with the specification as written for a Pulse Jet bag house.
1a.	Lime Injected Bag House	Alcoa wishes to stay with the specification as written for a Pulse Jet bag house. Alcoa does not want a screw conveyor used. Alcoa has
	Lime Injected Bag House Is a Reverse Air Bag House acceptable to Alcoa?	Alcoa wishes to stay with the specification as written for a Pulse Jet bag house. Alcoa does not want a screw conveyor used. Alcoa has specified sloped bottom hoppers and a rotary valve
1a. 1b.	Lime Injected Bag House Is a Reverse Air Bag House acceptable to Alcoa? Screw conveyor discharge from bag house	Alcoa wishes to stay with the specification as written for a Pulse Jet bag house. Alcoa does not want a screw conveyor used. Alcoa has
1a. 1b.	Lime Injected Bag House Is a Reverse Air Bag House acceptable to Alcoa? Screw conveyor discharge from bag house Lime Feed System	Alcoa wishes to stay with the specification as written for a Pulse Jet bag house. Alcoa does not want a screw conveyor used. Alcoa has specified sloped bottom hoppers and a rotary valve discharge for each cell.
1a. 1b.	Lime Injected Bag House Is a Reverse Air Bag House acceptable to Alcoa? Screw conveyor discharge from bag house	Alcoa wishes to stay with the specification as written for a Pulse Jet bag house. Alcoa does not want a screw conveyor used. Alcoa has specified sloped bottom hoppers and a rotary valve discharge for each cell. Alcoa requires the lime silo atmosphere and any process air
1a. 1b. 2.	Lime Injected Bag House Is a Reverse Air Bag House acceptable to Alcoa? Screw conveyor discharge from bag house Lime Feed System	Alcoa wishes to stay with the specification as written for a Pulse Jet bag house. Alcoa does not want a screw conveyor used. Alcoa has specified sloped bottom hoppers and a rotary valve discharge for each cell. Alcoa requires the lime silo atmosphere and any process air (Air that is used to convey the lime into the flue gas duct) to
1a. 1b.	Lime Injected Bag House Is a Reverse Air Bag House acceptable to Alcoa? Screw conveyor discharge from bag house Lime Feed System	Alcoa wishes to stay with the specification as written for a Pulse Jet bag house. Alcoa does not want a screw conveyor used. Alcoa has specified sloped bottom hoppers and a rotary valve discharge for each cell. Alcoa requires the lime silo atmosphere and any process air (Air that is used to convey the lime into the flue gas duct) to be at or below 50% Relative Humidity. The RH shall be
1a. 1b. 2.	Lime Injected Bag House Is a Reverse Air Bag House acceptable to Alcoa? Screw conveyor discharge from bag house Lime Feed System	Alcoa wishes to stay with the specification as written for a Pulse Jet bag house. Alcoa does not want a screw conveyor used. Alcoa has specified sloped bottom hoppers and a rotary valve discharge for each cell. Alcoa requires the lime silo atmosphere and any process air (Air that is used to convey the lime into the flue gas duct) to
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3.	Roof Thermocouple Placement	T	
3a.	Alcoa has had continual issues with roof thermocouples	Alcoa would like the furnace manufacturer to describe the placement and reliability of any roof thermocouple incorporated in the furnace design and control scheme along with detailed plans for where they are placed in the chamber and how they must be maintained. DATED: 5-4-2018	
	ADDENDUM NO. 7		
1.	Coil Size for Charging		
1a.	What is the width of the 92" diameter coil to be charged?	50 " wide	
1b.	What is the weight of the heaviest coil?	30,000 lbs.	
1c.	What chamber will the 92" dia. coil be charged into?	Dry Hearth, since it is coated scrap.	
1d.	What type of machine and/or strategy would be used to charge the coil?	Charge machine provided by the Furnace Mfg. If 30,000 lbs exceeds the capacity of the charge machine proposed by the Furnace Mfg, then Alcoa has fork trucks available that should be capable of placing the coil directly on the dry hearth. It will be the Furnace Mfg's responsibility to work with Alcoa to design of the furnace door front such that a "common Alcoa fork truck" can place a coil on the dry hearth before the fork truck mast impacts the furnace door headache bar.	
1e.	What is the expected frequency of charging the large coils on a daily basis?	Alcoa's historical data indicates there is an average of 21 coils per year over 20,000 lbs that must be melted. See attached distribution of scrap coil data from 2017. Coated Furnace Coated Coils Scrap Mix (2-13-2017 Distribution.xlsx	
	ADDENDUM NO. 8	DATED: 6-5-2018	
1.	Acceptance Testing		
1a.	Salt Feed System	Alcoa has added the following acceptance test to the RFQ. Salt Feed System Acceptance Test (5-3	
2.	APC Blower		
2a.	The RFQ requested VFD drives on APC Baghouse Blower.	Alcoa would like to have the APC blower on VFD controls.	
3.	Utilities	·	
3a.	Plugger tank and oiler	Please include plugger tank and oiler for any Alcoa plugger system used.	
4.	Refractory		
4a.	Rock Screen - Alcoa would like to use the Warrick designed Rock Screen	Please provide the bar type rock Screens used at Warrick that are manufactured by Vesuvius.	
4b.	Alcoa Vortex - Supply of Alcoa Vortex shapes	Manufacturer shall purchase, deliver and install the Alcoa Vortex refractory shapes from the approved Alcoa supplier. The supplier shall sale the components to the manufacturer at Alcoa's corporate pricing.	

5.	Scheduling and Meetings	
**	Engineering Schedule	- Submit drawings to Alcoa Engineering for "APPROVAL" per the following dates. (Referenced to weeks from "Contract Award") • 4 wks Preliminary GA's • 8 wks Furnace Foundation Load Data • 11 wks Complete (Final) GA's • 17 wks Interim Detailed Engineering • 24 wks Final Detailed Engineering • 6 weeks after completion of Final Acceptance Testing shall submit all As-Built Drawings to Alcoa All IFC drawings must be approved by Alcoa
5a.		Representative prior to beginning fabrication - Alcoa must be given 2 weeks for approval of drawings - Contractor is responsible for checking for drawing errors and references - IFC Foundation loading drawings must be submitted for approval to Alcoa no later than 8 weeks after Alcoa issues contract to contractor. If contractor changes the foundation design or any criteria that affects the design of the furnace or baghouse foundations after that date. Then contractor will be responsible for ALL CHARGES that are incurred to make said changes. This includes, but not limited to, engineering and drafting services, and any materials or labor if construction is affected.
5b.	Alcoa feels design meeting with the manufacturer is critical.	Alcoa would like to request design meetings two times per week for the first eight weeks of the design then one time per week, or more if needed, for the remainder of the design. These design meetings will also focus on physical layout of equipment being adequate for both Production and Maintenance Access. (e.g. piping does not block access to equipment, routinely maintained items such as UV detectors are easily accessible from floor level or from maintenance work platforms, hard to reach equipment has additional access designed such as permanent hoists, trolleys, and/or platforms, etc.). Maintenance schedules and procedures must be provided for each piece of equipment to support the required 85% availability of equipment.
5c.	Construction Red Line/markup Meetings	Alcoa will require at a minimum weekly meetings for this review function.
6.	Liquidated Damages for Delays	
6a.	Additional Liquidated Damages: Completed As-Built drawings are expected six (6) weeks after acceptance testing has been completed.	There will be a \$50,000 holdback to the engineering cost for As-Built Drawings. Damages shall be assessed at \$10,000 per week up to 5 weeks. Final payment of engineering will not be made until the accuracy of these drawings has been verified by Alcoa. This will be in addition to the 5% contract price cap on Liquidated Damages for Delays as stated in the RFQ.
7.	Lime Feed System	

7a.	Reliability and low maintenance.	Special consideration shall be given for providing equipment & procedures that keep the lime system operational at a minimum of 85% availability.
8.	Warranties	
8a.	Alcoa is requesting the following warranties: This request is Alcoa's expectations for a turnkey design/build contract warrantee and will be a negotiating point in final contract discussions.	 24 months material and workmanship warrantee from date of Alcoa acceptance of the furnace on all materials, fabrications, and installations of all components provided by the contractor and all subcontractors. Upon written notification from Alcoa of an issue, the contractor shall respond within two (2) days to identify the specifics of the problem and their resolution. Any and all costs associated with diagnosing and identifying the issue will be at the cost of the contractor. If during the diagnosing it is identified, and agreed to by Alcoa, to be an Alcoa operational issue than the cost of the diagnosis will be a cost to Alcoa. Contractor must make every possible effort to resolve the issue as quickly as possible including any special fees, expediting, and labor overtime required to procure and install needed materials, equipment, and labor. 12 month warrantee on all furnace, flue, and duct refractory materials, anchoring systems and installation from the completion date of furnace acceptance testing. The warrantee excludes any abuse by the owner's operational misuse. Warrantee repairs shall cover non routine operational repairs up to complete furnace relining if material of anchoring system failures occur. If any refractory is replaced the new installations must be warranted for an additional 12 months from date if installation. 12 month warrantee on all purchased shelf components included in the build and operation of the furnace complex, which includes CSM Furnace, APC Bag House, lime system, salt system, scrap conveyor system, etc. shall be warranted by the contractor for removal, purchase, delivery, installation, and startup for this period. If a component is replaced the new component must be warranted with a new 12 month period from date of installation. All costs of removal or demolition, material, equipment, tools, delivery to site, fees, expediting, installation, labor, and start up for warrantee repair will be the responsibility of the contractor. <l< th=""></l<>
	ADDENDUM NO. 9	DATE:6-14-2018
1	Emissions	
1a.	Alcoa requires the following changes to the	Emission Units ton/yr.

	specification Request for Quotation: CSM-R1 Dated 02-13-2018, section <u>C.26</u> . <u>Emissions</u>	CO ₂ from CO ₂ to NO _x from NO _x to	7.21 79.72 8.59 39.00
		PM from PM to	0.16 13.14
		PM ₁₀ from PM ₁₀ to PM _{2.5} from	0.65 7.94 0.65
		PM _{2.5} to VOC from	7.12 0.47
		VOC to CO _{2e} from CO _{2e} to	5.0 10,369 40,193
		Add the following	16.03
		CL ₂ HF	1.44 1.60
	ADDENDUM NO. 10	DATE:6-15-2018	
1	Salt Feed Addition		
1a.	Alcoa requires the salt feed system to be capable of feeding two salt types and at two different feed rates. Alcoa will feed the Amcor A-103-2 salt as shown in Addendum No.3 item 1a above AND BR Basic ALC.	Feed rate of both salts will be at a 3% to 5% rate, based on scrap charge weight. Maximum feed rate of 4500 pounds per hour and normal rate of 900 pounds per hour. Hopper volume must be capable of holding a 2 day supply of salt necessary for the 5% feed rate. (Note: Alcoa will provide approximately a 20 ft. x 20 ft. x 10 ft. height steel bin to contain the bulk salt. Alcoa & furnace vendor must coordinate the design to best facilitate the salt feeding equipment that shall be designed by the furnace vendor.)	
		SDS.pdf	•

ATTACHMENT C- Terms and conditions in accordance with MSA

6

ATTACHMENT C

STANDARD TERMS AND CONDITIONS FOR DESIGN, BUILD AND INSTALL EQUIPMENT CONTRACTS (rev 7-17)

Section 1. Definitions.

- (A) "Applicable Environmental Laws" means any and all laws concerning the protection of human health and the environment which include, but will not be limited to, the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§ 9601 et seq.; the Resource Conservation and Recovery Act, 42 U.S.C. §§ 6901, et seq.; the Federal Water Pollution Control Act, 33 U.S.C. §§ 1251 et seq.; the Clean Air Act, 42 U.S.C. §§ 7401 et seq.; the Hazardous Materials Transportation Act, 49 U.S.C. §§ 1471 et seq.; the Toxic Substances Control Act, 15 U.S.C. §§ 2601 through 2629; and the Safe Drinking Water Act, 42 U.S.C. §§ 300f through 300j; as they have been or will be amended from time to time, and the regulations implementing such statutes; and any similar state and local laws and ordinances concerning the protection of human health and the environment and the regulations implementing such statutes.
- (B) "Associated Services" means the training, technical assistance, installation and/or other services to be performed by the Seller under the Contract all as set out in more detail in the Contract.
 - (C) "Company" means Alcoa USA Corp. or any subsidiary or affiliate of Alcoa USA Corp. issuing the Contract to which this document is attached.
 - (D) "Company's Requirements" means the document(s) specifying the purpose, scope, and/or design and/or other technical and other criteria for the Equipment and Services
 - (E) "Contract" means these Standard Terms and Conditions for Design, Build and Install Equipment Contracts ("Terms and Conditions") together with all documents specifically referenced herein and any written purchase order, contract or agreement which attaches, incorporates or otherwise references these Terms and Conditions.
 - (F) "Contract Particulars" means the document identified as such that is attached to the Contract.
 - (G) "Contract Price" means the agreed lump sum amount stated in the Contract for the performance of the Work (including for the avoidance of doubt the design, manufacture and delivery of the Equipment and the performance of the Associated Services).

- (H) "Equipment" means the equipment to be designed, manufactured and delivered by the Seller in accordance with the Contract, as set out in more detail in the Company's Requirements.
- (I) "Facility" means the facility into which the Equipment is to be incorporated as identified in the Contract.
- (J) "Final Engineering Documentation" shall mean the final and complete design/engineering documentation from the Seller for each discipline of work, as set out in the Seller's Commitment Form (SCF).
- (K) "Hazardous Substance(s)" means any substance, material, chemical or waste that is or will be listed or defined as hazardous, toxic or dangerous under any Applicable Environmental Law, or any petroleum products, or any substance, material, chemical or waste which is or may become, directly or indirectly, by chemical reaction or otherwise, hazardous, toxic or dangerous to life, health, property or the environment by reason of toxicity, flammability, explosiveness, corrosivity or any other reasons.
- (L) "Milestone" means such part of the Work that is stated in the Contract Particulars to be completed by a Milestone Date.
- (M) "Milestone Date" means the time stated in the Contract Particulars for completing a Milestone.
- (N) "Minimum Performance Standards" means the minimum standards required to be achieved by the Equipment in the Performance Tests as set out in the Contract.
- (O) "Performance Guarantees" means the guaranteed performance standards to be achieved by the Facility in the Performance Tests as set out in the Company's Requirements.
- (P) "Performance Liquidated Damages" means the liquidated damages payable under Section 18(C) in respect of a failure to achieve the Performance Guarantees, as specified in the Contract Particulars.
- (Q) "Performance Security" means the performance security to be provided by the Seller in accordance with Section 20.
- (R) "Performance Tests" means the tests to be carried out by the Company pursuant to Section 19.
- (S) "Performance Test Repetition" means any repetition of the Performance Tests pursuant to Section 19.
 - (T) "Premises" means property owned, leased or administered by Company or, if applicable, property which is owned, leased or administered by others, which

contains within its boundaries the site where the Work is to be or is being performed, unless provided otherwise in the Contract.

- (U) "Progress Milestones" means those achievements, events or measures of progress of the Work, as defined in the Contract, which are required to be met by Seller for payments by Company.
- (V) "Seller" means the individual, corporation or other entity other than Company who is a party to this Contract.
- (W) "Seller's Documents" means the calculations, computer programs and other software, drawings, manuals (including operation and maintenance manuals), models and other documents of a technical nature supplied by the Seller under the Contract.
- (X) "Seller's Personnel" means the Seller's Representative and all personnel whom the Seller utilizes in the performance of the Work, who may include the staff, labor and other employees of the Seller and of each Subcontractor; and any other personnel assisting the Seller in the performance of the Work.
- (Y) "Seller's Representative" means the person named by the Seller in the Contract or appointed from time to time by the Seller under Section 3, who acts on behalf of the Seller.
- (Z) "Services" means all the services to be performed by the Seller under the Contract, including (i) the design, manufacture and delivery of the Equipment; (ii) the design of those parts of the Facility as detailed in the Company's Requirements as being the responsibility of the Seller; and (iii) the performance of the Associated Services.
- (AA) "Subcontractor" means any person named in the Contract as a subcontractor, or any person appointed as a subcontractor for the performance of any part of the Work and the legal successors in title to each of these persons.
- (AB) "Test Result Statement" means a statement given by the Company pursuant to Section 19.
- (AC) "Time for Completion" means the time stated in the Contract Particulars for completing the design, engineering and delivery of all of the Equipment and performance of the Services as specified in the Contract Particulars.
- (AD) "Work" means collectively the Equipment and Services.

Section 2. Scope of Work and Acceptance.

All Work is supplied pursuant to this Contract. This Contract will become legally enforceable on the earlier of delivery of a signed acknowledgment, commencement of

performance or delivery according to schedule of all or any portion of the Work covered under this Contract, by Seller. Any acceptance of this Contract is limited to acceptance of the express terms of the offer contained on the face and back hereof. Without the written consent of Company's authorized representative, no additional or different terms proposed by Seller in its acknowledgement will be effective to modify the Contract and Seller will be deemed to have accepted the Contract without such modifications. Additional or different terms or any attempt by Seller to vary in any degree any of the terms of the Contract will be deemed material and are expressly objected to and rejected.

Section 3. Seller's Representative.

- (A) The Seller shall appoint the Seller's Representative and shall give him/her all authority necessary to act on the Seller's behalf under the Contract.
- (B) The Seller shall, on the date of execution of the Contract, submit to the Company for consent the names and particulars of the person the Seller proposes to appoint as Seller's Representative. If consent is withheld or subsequently revoked, or if the appointed person fails to act as Seller's Representative, the Seller shall similarly submit the name and particulars of another suitable person for appointment.
- (C) The Seller shall not, without the prior consent of the Company, revoke the appointment of the Seller's Representative or appoint a replacement.
- (D) The Seller's Representative may delegate any powers, functions and authority to any competent person, and may at any time revoke the delegation. Any delegation or revocation shall not take effect until the Company has received prior notice signed by the Seller's Representative, naming the person and specifying the powers, functions and authority being delegated or revoked.
- (E) The Seller's Representative and all persons delegated any powers pursuant to paragraph (D) above shall be fluent in the English language.

Section 4. Seller's Personnel.

- (A) The Seller's Personnel and any Subcontractor's personnel shall be appropriately qualified, skilled and experienced in their respective trades or occupations for the proper and timely performance of the Work. No Seller's Personnel or Subcontractor's personnel engaged in providing any Work hereunder shall be assigned by the Seller or the Subcontractor to work on any similar projects for any competitor of the Company until the completion of the Work hereunder, without the prior consent of the Company.
- (B) The Company may object to and require the Seller and any Subcontractor to remove (or caused to be removed) any person employed by the Seller or by a Subcontractor in the performance of the Work who in the opinion of the Company

misconducts himself/herself or is incompetent or negligent in the performance of his/her duties, or whose employment is considered undesirable or who any relevant public authority requires to be removed, or fails to conform with any provision of the Contract. Any person so removed shall be replaced as soon as possible by a competent substitute at no cost to the Company. The Seller shall comply as soon as practicable with such requirement, which shall not be subject to challenge.

(C) The Seller shall at all times be responsible for providing and maintaining all necessary accommodation and welfare facilities for the Seller's Personnel. The Seller shall be responsible for the payment, housing, feeding and transport of the Seller's Personnel.

Section 5. Company's Representative's Duties and Authority.

- (A) The Company's Representative shall carry out the duties assigned to him/her in the Contract. The Company's Representative's staff shall include suitably qualified engineers and other professionals who are competent to carry out these duties.
- (B) The Company's Representative shall have the authority to act on behalf of the Company in such matters pertaining to the Services as specified herein, including giving of instructions, oral or otherwise, and determining amounts, quality, acceptability and fitness of the Services in accordance with this Contract. Except as expressly stated in the Contract, the Company's Representative shall have no authority to amend, modify or supplement the Contract or to agree to amendments to the Contract or to relieve either party of any risk, duty, obligation or liability under or arising from the Contract, at law or otherwise. Except as expressly stated in a written notice from the Company to the Contractor, the Company's Representative shall have no authority to terminate the Contract or the Seller's employment thereunder or to refer any dispute to mediation or arbitration.
- (C) Except as otherwise stated in the Contract:
 - (1) whenever carrying out duties or exercising authority specified in or implied by the Contract, the Company's Representative shall be deemed to act for the Company; and
 - (2) any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by the Company's Representative (including absence of disapproval) shall not relieve the Contractor from any responsibility it has under the Contract, including responsibility for defects, errors, omissions, discrepancies and non-compliances.

- (D) If the Company intends to replace the Company's Representative, the Company shall give prior notice to the Seller of the name, address, duties and authority, and date of appointment of the replacement Company's Representative.
- (E) The Company may from time to time assign duties and delegate authority to assistants and may also revoke such assignment or delegation. The assignment, delegation or revocation shall be notified by the Company to the Contractor in writing and shall not take effect until notice has been received by the Contractor.
- (F) Any assistant, including the Company's Representative, to whom duties have been assigned or authority has been delegated, shall only be authorized to issue instructions to the Contractor to the extent defined by the delegation. Any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by an assistant, in accordance with the delegation, shall have the same effect as though the act had been an act of the Company. However:
 - (1) any failure to disapprove any Services, Equipment, or Facility (to the extent that the Contractor is responsible for the design of the Facility) shall not constitute approval, and shall therefore not prejudice the right of the Company to reject the Services, Equipment or Facility; and
 - (2) if the Contractor questions any determination or instruction of an assistant, the Contractor may refer the matter to the Company, who shall promptly confirm, reverse or vary the determination or instruction.
- (G) The Company may issue to the Contractor (at any time) instructions and additional or modified drawings which the Company considers necessary for the execution of the Services and the remedying of any defects, all in accordance with the Contract. The Contractor shall only take instructions from the Company, or from the Company's Representative, or from an assistant to whom the appropriate authority has been delegated under this Section. The Contractor shall comply with the instructions given by the Company, or by the Company's Representative or a delegated assistant (acting within the scope of their authority), on any matter related to the Contract.

Section 6. Site and Other Examinations - Observance of Laws.

- (A) Seller represents that it has procured a license to do business, if required by law, and has complied with all other legal requirements before submitting a bid for the Work or performing any Work. Seller and the Work will comply with all applicable foreign, federal, state and local laws, rules, regulations, orders, conventions, ordinances or standards including, but not limited to, those relating to environmental matters, data protection and privacy, wages, hours and conditions of employment, subcontractor selection, discrimination, occupational health/safety and motor vehicle safety.
- (B) Seller represents that it has carefully examined the drawings and specifications, governmental restrictions, permits and license requirements, and all other laws and rules applicable to the Work. Seller further represents it has visited the Premises, has made all investigations essential to a full understanding of the difficulties which may be encountered, and has special qualifications for doing the Work.

(C) Seller must, before commencing the Work, obtain, at its own expense, all necessary permits (except building permits), licenses and approvals from all applicable government authorities and agencies which are necessary for performance of the Work for Company, and must, in the performance of the Work, observe and abide by all applicable laws, regulations, ordinances, governmental restrictions and other rules.

Section 7. Design Obligations; Specifications and Drawings.

- (A) The Seller shall be deemed to have scrutinized, prior to the date of the Contract, the Company's Requirements (including design criteria and calculations, if any).

 The Seller shall be responsible for the design of:
 - (1) the Equipment; and
 - (2) such other elements of the Facility as are indicated in the Company's Requirements to fall within the scope of the Seller's responsibility,

and takes full responsibility for the accuracy of such Company's Requirements for such purpose (including design criteria and calculations), except as stated in paragraph (C) below.

- (B) The Company shall not be responsible for any error, inaccuracy or omission of any kind in the Company's Requirements as originally included in the Contract and shall not be deemed to have given any representation of accuracy or completeness of any data or information except as stated in paragraph (C) below. Any data or information received by Seller from the Company or otherwise, shall not relieve the Seller from responsibility for the performance of the Services and the design of the Equipment and Facility (to the extent the Seller is responsible for the design of the Facility under the Contract.)
 - (C) The Company shall be responsible for the correctness of the information expressly identified as "rely upon information" in the Company's Requirements.
- (D) The Seller undertakes that the design of the Equipment and (to the extent within the scope of its responsibility) the Facility, the Seller's Documents, and the performance of the Services will be in accordance with (i) the laws of the state in which the Facility is located, including building, construction and environmental laws; and (ii) the documents forming the Contract, as altered or modified by changes pursuant to Section 13 herein.
 - (D) Anything mentioned in the specifications and not shown on the drawings or shown in the drawings and not mentioned in the specifications, will be of like effect as if shown and mentioned in both. If there is any difference between the drawings and the specifications, the specifications will govern, but the matter will

be immediately submitted to Company's Representative without whose decision said difference will not be resolved by Seller, except at its own risk and expense.

- (E) All drawings, specifications, shop drawings and related documents, and all copies and all reproductions, whether created by Seller or Company, relating to the Work:
- (1) are the property of Company and must be delivered to Company upon request, or at the completion of the Work;
- (2) are provided to Seller, its subcontractors and material suppliers for the limited purpose of use in completing the Work, and may not be used for any other purpose without the prior written consent of Company;
- (3) are confidential and, except for the purpose specified above, may not be copied, exhibited, or disclosed to others without prior written consent of Company, and no photographs may be taken of any article fabricated or assembled from the drawings and/or specifications without the prior written consent of Company.

Section 8. Seller's Documents

- (A) The Seller's Documents shall comprise the technical documents to be supplied by the Seller hereunder, including those documents required under the Company's Requirements, all design documents to be produced by the Seller under the Contract and documents required to satisfy regulatory approvals.
- (B) As part of the Services, the Seller shall prepare all Seller's Documents and shall also prepare any other documents necessary to instruct the Seller's Personnel.
 - (C) If the Company's Requirements describe Seller's Documents which are to be submitted to the Company for review, they shall be submitted accordingly, together with a notice as described below. In the following provisions of this Section, (i) "review period" means the period required by the Company for review, and (ii) "Seller's Documents" exclude any documents which are not specified as being required to be submitted for review.
- (D) Unless otherwise stated in the Company's Requirements, each review period shall not exceed 15 days, calculated from the date on which the Company receives a Seller's Document and the Seller's notice. This notice shall state that the Seller's Document is considered ready, both for review in accordance with this Section and for use. The notice shall also state that the Seller's Document complies with the Contract, or the extent to which it does not comply.
 - (E) The Company may, within the review period, give notice to the Seller that a Seller's Document fails (to the extent stated) to comply with the Contract. If a

Seller's Document so fails to comply, it shall be rectified, resubmitted and reviewed in accordance with this Section, at the Seller's cost.

- (F) If the Seller wishes to modify any design or document which has previously been submitted for review, the Seller shall immediately give notice to the Company.

 Thereafter, the Seller shall submit reviewed documents to the Company in accordance with the above procedure.
- (G) Any such agreement (under the preceding paragraph) or any review (under this Section or otherwise) shall not relieve the Seller from any obligation or responsibility.
- (H) If errors, omissions, ambiguities, inconsistencies, inadequacies or other defects are found in the Seller's Documents, they and the Equipment and (to the extent within the scope of the Services) the Facility shall be corrected at the Seller's cost, notwithstanding any consent or approval of Company under this Section.
- (I) Any change made by the Seller after the delivery of the Final Engineering Documentation due to Seller's error or its design development which change results in an increase in associated costs (including rework by third party engineering firms or impact on construction in progress) shall be the sole responsibility of Seller.

Section 9. Materials and Workmanship.

Where machinery, equipment, or material are referred to in the Contract as equal to any particular standard. Company will decide the question of equality. When required by the Contract, or requested by Company, Seller will furnish Company with the name of the manufacturer, the performance capabilities, and other pertinent information necessary to properly determine the quality and suitability of any machines, equipment and material to be incorporated in the Work. Material samples will be submitted at Company's request. When the Contract specifies machinery, equipment or material by manufacturer, model, or trade name, no substitution will be made without Company's written approval. Machinery, equipment or material installed in the Work without the approval required by this Section 9 will be deemed to be defective material for purposes of Section 10.

Section 10. Inspections and Tests.

- (A) Company and its representatives will at all times have access to the Work wherever it is being performed, and Seller will provide proper facilities for such access and for inspection. When any item of Work is being executed away from the Premises, Seller will promptly notify Company of the location and the schedule for completion.
- (B) Company will have the right to reject defective materials or workmanship and to require their correction. Rejected workmanship will be satisfactorily corrected,

and rejected materials will be immediately removed from the work site, without charge to Company. If Seller does not correct such defective workmanship within a reasonable time or remove rejected materials immediately, Company may correct such defective workmanship or remove such rejected materials and charge the expense to Seller. Should Company at any time before final acceptance of the entire Work desire to make an examination of any items of Work already completed by removing or tearing out same, Seller will, upon request, promptly furnish all necessary facilities, labor, and materials for such an examination. If such items of Work are found to be defective in any material respect due to the fault of Seller or its subcontractors, Seller will pay all the expenses of such examination and of satisfactory reconstruction. If however, such items of Work are found to meet the requirements of the Contract, Seller will be reimbursed by Company for removal, examination and replacement, in accordance with Section 13.

- (C) Neither the failure of Company to exercise the right of inspection nor the failure to discover defective workmanship or material during such inspection will relieve Seller of its obligation to provide material and workmanship strictly in accordance with the Contract.
- (D) All laboratory tests required by Company will be made in a laboratory approved by Company, and Company will, unless otherwise provided in the Contract, pay Seller's actual costs of such tests and engineering services. Unless otherwise specified by Company, all tests will be made in accordance with the current standard methods of the American Society for Testing Materials governing the materials tested.

Section 11. Schedule For Completion -- Overtime -- Delays.

- (A) Seller will not be entitled to any damages or compensation for delays in the commencement, progress, or completion of the Work resulting from any cause whatsoever, except as specifically provided for in this Section 11.
- (B) If a delay is not caused by or contributed to by any act or omission of Seller, the time for completion will be extended by Company for a period of time determined by Company to be equivalent to the time of such delay. If Company requires Seller to work additional time to make up any such delays, Company will pay Seller for such additional time in accordance with the provisions of Section 13.
- (C) If Company directs Seller to cease the Work at Company's Premises, restrict its labor force, or otherwise delay or suspend the Work at Company's Premises, or if Company causes a delay or suspension of the Work at Company's Premises by its failure to provide for timely completion of work by others, timely delivery of machinery, material, or equipment which Company is required to provide, Company will, if personnel, equipment, and facilities are idled and cannot be

productively employed elsewhere, grant an extension of time and reimburse Seller or its subcontractors for the following:

- (1) Seller's on-site salaries for supervisory, clerical, and other office help;
- (2) the invoice cost of third party rental vehicles, equipment, and facilities; and
- (3) other similar expenses, including, but not limited to, Seller-owned equipment, tools, vehicles and facilities which Company judges to be reasonable.

The salaries of supervisors not located at the site, other overhead, other office expenses, and profit will not be paid, nor will any Seller markup of subcontractor billings be permitted. Seller will make every reasonable effort to minimize the cost to Company.

- (D) If any such delay is caused by or contributed to by any act or omission of Seller, no extension of time will be granted by Company, and Company will have the right to charge Seller for any costs paid by Company to others to eliminate the delay. Company may require Seller to work overtime at Seller's expense to make up any time lost as a result of such delay.
- (E) The time of Seller's performance is of the essence for this Contract. The Work will be completed in accordance with the schedule set forth in the Contract. Seller must immediately notify Company in writing any time the Work is behind schedule or may not be completed on schedule.
- (F) Any request for extension of time or compensation under this Section 11 must be made in writing within five (5) working days from the date the delay commences.
- (G) It is understood that others may work in the same area occupied by Seller. Seller will fully cooperate in scheduling the Work so that a minimum of interference will occur.

Section 12. Baseline Responsibility.

(A) Before proceeding with the Work, and from time to time as the Work progresses, Seller will examine work installed by others including but not limited to lines and grades which influence the Work and shall promptly notify Company in writing if any condition exists that will prevent Seller from satisfactorily completing the Work. If Seller proceeds without such notification and it is then necessary to reconstruct any part of the Work because of such condition, Seller will reconstruct such part without expense to Company.

(B) Seller will establish benchmarks and lines based on adjacent building columns, equipment bases, equipment operating surfaces or other reference monuments. Before proceeding with the Work, these controls will be reviewed with Company's representative. This review will not relieve Seller from its responsibility defined in (A) above or elsewhere in the Contract.

Section 13. Changes.

Company, at any time, by a written order, and without notice to any surety, may make changes in the Work, including but not limited to the drawings and the specifications. If such changes affect the cost of the Work or time required for its performance, an equitable adjustment will be made in the Contract price or time for performance or both. However, if specifically requested in writing by Company, Seller will proceed with the prosecution of the portion of the Work so changed without waiting for an agreement to be reached concerning such adjustment. Any change in the Contract price necessitated by such change will be made in accordance with one or more of the following methods acceptable to Company, and such change will be authorized by a change order document signed by Company and accepted by Seller:

- (A) by adding or deducting a lump sum (if requested by Company, Seller will provide a detailed cost breakdown);
- (B) by adding or deducting unit prices;
- (C) by adding with respect to additions to the Work on Company's Premises:
 - (1) actual straight time wage cost of all direct labor employed up to and including the first tier of foreman which includes base wage rate, payroll taxes consisting of FICA, Federal and State Unemployment; insurances consisting of Worker's Compensation Insurance and Commercial General Liability Insurance, fringe benefits, subsistence, and other contributions as determined by the applicable trade agreements, or prevailing wages and benefits established by Seller in the absence of trade agreements. The actual straight time wage cost of all direct labor will not include indirect costs for other supervisory, administrative, clerical, office, or other overhead expense whether incurred at the Work site or elsewhere. Seller will furnish one copy of each current trade agreement to Company;
 - (2) 20% of Section 13(C)(I) to cover all required safety and personal protection equipment, equipment and small tools (under \$5,000 replacement value), transportation within the site of personnel, items of material not consumed directly in the Work, superintendence above the first tier of foreman, all administrative, clerical, office, and other overhead expense incurred at the site or elsewhere, and profit;
 - (3) actual cost of the premium portion of approved overtime labor, including insurance, taxes, benefits, and other contributions required of Seller;

- (4) an amount for equipment, fueled, maintained but without operator, and tools used (over \$5,000 replacement value) at previously agreed rental rates;
- (5) actual cost of all materials furnished and expendable tools and supplies consumed directly in the Work (Seller to obtain all available discounts);
- (6) actual cost of any items of Work performed by subcontractors. (Subcontractors on a cost plus basis will be reimbursed by Seller in accordance with this Section 13(C));
- (7) 5% of Section 13(C)(5) and (6); and
- (8) actual cost of any sales tax paid on materials, tools, and supplies covered by Section 13(C)(5).

Separate records, subject to audit by Company, must be kept for any payments to be made pursuant to Section 13(C). Seller must submit for Company's approval a list of all wage costs determined pursuant to Section 13(C)(1) and (3) and a list of all equipment and tools with the rental rates to be charged pursuant to Section 13(C)(4). Any claim for adjustment under this Section 13 must be asserted in writing by Seller within ten (10) days from the date the change was ordered by Company. No claim for adjustment will be allowed unless the change was specifically ordered in writing by Company. The payment schedule for each change will be agreed to by Company and Seller and identified in a change order.

Section 14. Payments.

(A) Payments for the Work will be made according to Progress Milestones as specified in the Contract as the requirements of the Progress Milestones are met. Progress payments for the Work will be made by Company upon proper application by Seller during the progress of the Work and according to the terms of payment as specified in the Contract. Seller's progress billing invoice will include progress payments due for the original scope of work and changes. All invoices for Work provided to Company will be accumulated upon receipt for a period from the 1st day of a month to the last day of the month (the "Accumulation Period"). Company will pay invoices received during the Accumulation Period on the 4th day of the 4th month from the end of such Accumulation Period for Work that, in Company's judgment conform to the requirements of the Contract. Each "Item for Payment" shown in the original Contract and each change order will be itemized on the invoice. Invoices for cost plus work, whether part of the original Contract or a change as described in Section 13(C), must have subcontractor and/or materialman invoices attached to Seller's invoice. Other format and support documents for invoices will be determined by Company in advance of the first invoice cycle. Seller will promptly submit correct and complete invoices or other agreed billing communications with appropriate supporting documentation and other information reasonably required

by Company after delivery of the Work, and Company may withhold payment until a correct and complete invoice or other required information is received and verified. Any cash discounts will be based on the full amount of the invoice, less freight charges and taxes if itemized separately on the invoice. Delay in receiving valid invoices or Work will be considered good cause for withholding payment without losing cash discount privileges.

- (B) Payments otherwise due may be withheld by Company on account of defective Work not remedied, liens or other claims filed, reasonable evidence indicating probable filing of liens or other claims, failure of Seller to make payments properly to its subcontractors or for material or labor, reasonable doubt that the Contract can be completed for the balance then unpaid, the failure of Seller to perform any of its other obligations under the Contract, or to protect Company against any liability arising out of Seller's failure to pay or discharge taxes or other obligations. If the causes for which payment are withheld are removed, the withheld payments will be made promptly. If the said causes are not removed within a reasonable period after written notice, Company may remove them at Seller's expense. Company shall have the right, at any time, to setoff and apply against any monetary obligations that Company owes to Seller or any of its parents, subsidiaries or affiliates, any obligations that Company or any of its parents, subsidiaries or affiliates may owe to Seller.
- (C) Payment of the final Progress Milestone payment will be made by Company upon:
 - (1) submission of an invoice for satisfactory completion of the requirements of a Progress Milestone as defined in the Contract and in the amount associated with the Progress Milestone;
 - (2) written acceptance of the Work by Company:
 - (3) delivery of all drawings and specifications, if required by Company;
 - (4) delivery of executed full releases of all liens arising out of the Contract or any agreement supplemental to the Contract, or any subcontract made pursuant to or in connection with the performance under the Contract or any agreement supplemental to the Contract, or receipts in full in lieu thereof for Seller or subcontractor Work in excess of \$25,000 and
 - (5) delivery of an affidavit listing all persons who might otherwise be entitled to file, claim, or maintain a lien of any kind or character, and containing an averment that all of the said persons have been paid in full.

If any person refuses to furnish an actual release or receipt in full, Seller may furnish a bond satisfactory to Company to indemnify Company against any claim or lien at no cost to Company.

(D) Acceptance by Seller of payment of the final Progress Milestone payment pursuant to Section 14(C) will constitute a waiver, release, and discharge of any and all claims and demands of any kind or character which Seller then has, or can subsequently acquire against Company, its successors and assigns, for or on account of any matter or thing arising out of, or in any manner connected with, the performance of the Contract, or any agreement supplemental to the Contract. However, payment of the final Progress Milestone payment by Company will not constitute a waiver, release, or discharge of any claims or demands which Company then has, or can subsequently acquire, against Seller, its successors and assigns, for or on account of any matter or thing arising out of, or in any manner connected with, the performance of the Contract or any agreement supplemental to the Contract.

Section 15. Price/Terms.

Seller warrants that the Contract Price is complete and that no additional charge of any type will be added without Company's express written consent in advance. Company will have the right to examine and audit, during normal business hours, any and all records, data and documents, in whatever shape or form, including, but not limited to, electronic media, that may contain information relating to Seller's obligations as set forth in this paragraph. Such records will be kept in a form that is clear and accurate and containing content sufficient and adequate detail to permit the aforementioned audit. Except as expressly set forth in this Contract, Company will have no obligation to purchase any specific quantity of Work from Seller and Company will be entitled, in its sole discretion, to purchase the same or similar Work from other suppliers. Company expressly reserves the right to disclose the terms of this Contract, including but not limited to price, to third parties.

Section 16. Taxes.

- (A) Seller will bear and pay all applicable taxes of the United States and any other country, including any political subdivision of any of them, if the tax is based on or measured by gross receipts or net income, or payment of which is required to maintain a legal existence or a general right to transact business within the taxing jurisdiction.
- (B) Seller will withhold, and require its subcontractors, where applicable, to withhold all required taxes and contributions of the United States, any other country or any political subdivision of any of them which is measured by wages, salaries or other remuneration of its employees or the employees of its subcontractors as required by the United States Internal Revenue Code, the United States Federal Insurance Contribution Act, the United States Federal Unemployment Act, and any laws of any other country or any political subdivision of any of the foregoing which requires withholding of any income or employment taxes as measured by wages, salaries or other remuneration. Seller will deposit, or cause to be deposited, in a

timely manner with the appropriate taxing authorities all amounts required to be withheld.

- (C) Company agrees to pay all value added tax and sales and use tax (including any gross receipts tax imposed similar to a sales and use tax) imposed by any foreign, national, state or local taxing authority on the ultimate purchase price of the Work provided under this Contract. If Seller is required to collect such value added tax or sales and use tax on behalf of any taxing jurisdiction, Seller will provide to Company invoices which separately state and clearly indicate the amount of tax, and Company will remit any such tax to Seller. Seller will have the responsibility of complying with all applicable foreign, national, state or local laws regarding value added tax and sales and use tax or substitutes therefor including registration, collection of taxes and the filing of returns where applicable. Notwithstanding whether Seller must collect value added tax or sales and use tax from Company, Seller will state on every invoice the taxing jurisdiction (e.g. country, state and local jurisdiction) in which the Work invoiced, or allocated portion thereof, was provided. If applicable, in lieu of payment for any sales and use tax, Seller will accept a properly executed exemption or direct pay certificate from Company. The determination of whether an exemption or direct pay certificate will be submitted to Seller in lieu of payment for any sales and use tax will be made by Company on a location by location basis.
- (D) With the exception of value added tax and sales and use tax as described in Section 16(C) above, all other taxes, however denominated or measured, imposed upon the price or compensation under this Contract, or upon the Work provided hereunder, will be the responsibility of Seller. In addition, all taxes assessed by any taxing jurisdiction based on Seller property used or consumed in the provision of the Work such as and including ad valorem, use, personal property and inventory taxes will be the responsibility of Seller. The parties will cooperate in good faith to minimize such tax liabilities to the extent legally permissible.
- (D) Seller and subcontractors will file such returns, reports or forms necessary for the payment of all taxes which Seller is required by law to file.
- (E) Seller will, upon written request, submit to Company written evidence of any filings or payments of all taxes, including government-furnished receipts and detailed documentation of a taxing authority. Company reserves the right to contest, or cause Seller to contest, any tax, fee or assessment, and Seller will use its best efforts in cooperating with Company in any such contest.

Section 17. Warranty.

(A) Seller warrants that the Work will be performed using reasonable care and skill, will comply in all respects with the requirements of the Contract and applicable laws and will be free from defects in design, engineering, material and workmanship for the period of time set forth in the Contract Particulars. For any

breach of the above warranties, Seller will, immediately after receiving notice from Company, at the option of Company, and at Seller's own expense and without cost to Company:

- (1) repair the defective Work;
- (2) replace the defective Work with conforming Work, F.O.B. Company's plant, office or other location of Company where the Work was originally performed; or
- (3) repay to Company the purchase price of the defective Work.

If Company selects repair or replacement, any defects will be remedied without cost to Company, including but not limited to, the costs of removal, repair and replacement of the defective Work, and reinstallation of new Work. All such defective Work that is so remedied will be similarly warranted as stated above. In addition, Seller will repair or replace other items of the Work which may have been damaged by such defects or the repairing of the same, all at its own expense and without cost to Company. If Seller fails to repair or replace any defective Work in a timely manner, Company may do so, and Seller will reimburse Company for actual and reasonable expenses.

- (B) Seller warrants that any machinery, equipment, or process, the design of which is the responsibility of Seller, will meet the performance requirements specified in the Contract. Company's inspection, testing, approval, or acceptance of any such machinery, equipment, or process will not relieve Seller of its obligations under this Section 15(B).
- (C) In the event of a breach by Seller of its obligations under this Section 17, Company will not be limited to the remedies set forth in this Section 17, but will have all the rights and remedies permitted by the Contract and by law. All warranties and other provisions of this Section 17 will survive inspection or acceptance of and payment for the Work and completion, termination or cancellation of this Contract.
- (D) Company's occupancy of the Work site, or any portion of the Work site, will not constitute acceptance or approval of the Work or any such portion of the Work.
- (E) When the warranty period for all Equipment has expired and the Seller has fulfilled all its obligations under the Contract, the Company will issue within 28 days to the Seller a certificate to that effect (the "Performance Certificate"). No payment by the Company nor issuance of the Performance Certificate or any other certificate or valuation, under the Contract shall prejudice or affect any right or remedy of the Company.

Section 18. Performance Guarantees.

- (A) The Seller guarantees and undertakes that the Facility shall achieve the Performance Guarantees and Minimum Performance Standards set out in the Company's Requirements upon the execution of the Performance Tests, or any Performance Test Repetition.
- (B) The Company may, in its absolute discretion, waive by notice in writing to the Seller the requirement for the Performance Tests, in which case the Performance Guarantees shall be deemed to have been achieved on the date of such waiver.
- (C) Where the Facility fails to meet the Performance Guarantees in the Performance Tests or Performance Test Repetitions (as appropriate) and such failure is attributable to the Equipment or the performance of the Services by the Contractor, the Contractor will pay Performance Liquidated Damages to the Company as set out in the Contract Particulars. The Seller shall pay any Performance Liquidated Damages under this Subsection 18(C) to the Company within 21 days after demand by the Company. If one or more Performance Tests or Performance Test Repetitions are carried out, the level of Performance Liquidated Damages payable pursuant to this subsection shall be calculated by reference to the last Performance Test Repetition completed. The parties agree that the Performance Liquidated Damages set out in the Contract Particulars are a genuine, fair and reasonable pre-estimate of the actual damages that will be suffered by the Company as a result of a failure to achieve the Performance Guarantees and do not constitute a penalty. The payment by the Seller of Performance Liquidated Damages pursuant to the Contract shall not relieve the Seller from its obligations to complete the Work in accordance with the Contract, nor from any other duties, obligations or liabilities under the Contract.

Section 19. Performance Tests

- (A) The Company shall give to the Seller not less than 21 days' notice of the date on which the Company intends to carry out each of the Performance Tests (as more particularly described in the Company's Requirements and which shall include any "Hot Commissioning" requirements started therein.
- (B) If the Performance Tests are not conducted within the time period stated in the Company's Requirements for reasons attributable to the Company, the Performance Tests shall be deemed to be successful and the Performance Guarantees shall be deemed to be achieved.
- (C) If the Seller fails to attend the Performance Tests, they shall be deemed to have been carried out in the presence of the Seller and the results of the Performance Tests shall be accepted as accurate.

- (D) In considering the results of the Performance Tests, appropriate allowances shall be made for the effect of any use of the Facility by the Company on the performance or other characteristics of the Facility.
- (E) Within 7 days after the first carrying out of each of the Performance Tests and within 3 days after the carrying out of any Performance Test Repetition (as described below), the Company shall submit to the Seller a Test Result Statement of the results thereof which shall be binding on the Seller hereunder. Such a Test Result Statement shall, as a minimum, state whether the relevant Minimum Performance Standards and Performance Guarantees were achieved during the relevant test.
- (F) If the Test Result Statement issued by the Company shows that the Facility failed to achieve any of the Performance Guarantees or Minimum Performance Standards, and such failure is attributable to the Equipment or the performance of the Services by the Seller, the Seller shall at the Company's option, (i) carry out the necessary remedial works to remedy the shortfall in performance and require the Company to perform as soon as reasonably practicable and at a time nominated by the Company a Performance Test Repetition or (ii) pay Performance Liquidated Damages. The Seller shall not be entitled to payment for remedial work or Performance Test Repetitions carried out in the Company's discretion.
- (G) Prior to carrying out any Performance Test Repetition, the Seller shall notify the Company in writing of the works which may be necessary to improve the performance of the Facility and shall then, subject to the consent of the Company (which shall not be unreasonably withheld), carry out such work in accordance with a programme agreed with the Company.
- (H) If the Company elects not to carry out a further Performance Test Repetition or if 3 Performance Tests Repetitions (or such greater number as the parties may agree to in writing) have been carried out, and the Facility has achieved the Minimum Performance Standards but has failed to achieve all Performance Guarantees applicable thereto, and such failure is attributable to the Equipment or the performance of the Services by the Seller, then without prejudice to any other right or remedy of the Company:
 - (1) the Seller shall not be entitled to carry out any further remedial work or require the carrying out of any further Performance Test Repetitions; and
 - (2) the Seller shall be required to pay the Company the appropriate Performance Liquidated Damages in respect of such failure to achieve the Performance Guarantees in accordance with Sub-Clause 18(C).
- (I) If the Company elects not to carry out a further Performance Test or if 3 Performance Test Repetitions (or such greater number as the parties may agree to in writing) have been carried out, and the Facility has failed to achieve all or any of the Minimum Performance Standards applicable thereto, and such failure is

attributable to the Equipment or the performance of the Services by the Seller, then the Company may reject the Equipment by notice in writing. Any Test Result Statement issued under this Subsection shall record the results of the relevant tests and record that the Facility failed to achieve the Minimum Performance Standards. If the Company rejects the Equipment pursuant to this Subsection then, at the Company's option and without prejudice to the Company's entitlement to any Performance Liquidated Damages under the Contract or to any other right or remedy of the Company:

- (1) the Seller shall forthwith proceed with all due dispatch to repair or remedy the defective Equipment or provide replacement Equipment and Services or any part or parts thereof complying in all respects with the requirements of the Contract, to enable the Company to carry out again all relevant Performance Tests in respect of the Facility, and remove from the Site the rejected Equipment or parts thereof, as may be applicable, all at the Seller's own risk and expense; or
- (2) the Company may terminate the Contract by notice in writing to the Seller and the Company shall be entitled to recover from the Seller all sums paid for the Equipment and Services and the cost of dismantling the Equipment and clearing and restoring the Facility and the Site, all of which shall be a debt due from the Seller to the Company and paid by the Seller to the Company on demand by the Company from time to time.
- (J) Prior to commencement of the Performance Tests, the Seller will supply to the Company provisional operational and maintenance manuals in sufficient detail for the competent personnel to fully, safely, reliably and efficiently operate and maintain, adjust, dismantle, re-assemble and repair the Equipment and each part thereof. Promptly after successful completion of the Performance Tests, the Seller shall supply to the Company final operation and maintenance manuals adjusted to reflect actual operation of the Facility, and any other manuals specified in the Company's Requirements for these purposes.

Section 20. Performance Security

- (A) The Seller shall obtain (at its cost) a duly executed Performance Security in the amount of 10% of the Contract Price in the form attached to the Contract, from a bank approved by the Company.
- (B) The Performance Security referred to above shall be delivered to the Company no later than 14 days from the date of the Contract. The Seller shall ensure that the Performance Security shall be valid and effective until the issuance of the Performance Certificate under Section 17(E). The Seller shall extend the validity of the Performance Security as necessary until such time as all the Services have been completed and all defects have been rectified and the Performance Certificate has been issued.
- (C) Should the Contract Price increase or decrease at any time after the date of the Contract by an amount equal to or greater than 5% of the initial Contract Price, the Seller shall procure that the value of the Performance Security shall be

adjusted accordingly (or a replacement Performance Security shall be issued to the Company in the adjusted amount) within 21 days of such increase or decrease. If, following any such adjustment or reissuance of the Performance Security, the Contract Price should increase or decrease by a further amount equal to or greater than 5% of the Contract Price at the time of such adjustment or reissuance, the Seller shall procure that the value of the Performance Security shall be readjusted accordingly (or a replacement Performance Security shall be issued to the Company in the adjusted amount) within 21 days of such increase or decrease.

- (D) The Seller must provide the Performance Security as a condition precedent to the Seller acquiring any right to payment under the Contract or otherwise from the Company.
- (E) Should the Performance Security prove not to be enforceable at any time for any reason or the Seller fails to issue, adjust or reissue the Performance Security as required by this Subsection (E), the Company may suspend all payments to the Seller until the Seller has furnished to the Company a valid Performance Security.

Section 21. Independent Contractor.

- (A) Seller is an independent contractor and not an employee or agent of Company.

 Company disclaims any right to control the manner of performance by Seller and Company will not control the manner of performance by Seller.
- (B) Seller has no authority to direct or control the performance of any employee of Company. Seller's role will be that of adviser and not of master to any Company employee.
- (C) Seller does not have any Company title and Seller is not eligible for Company benefits or employee plans.

Section 22. Subcontracts.

Unless otherwise specified, Seller must obtain Company's written permission before subcontracting any portion of the Work. Except for the insurance requirements in Section 27, all subcontracts and orders for the purchase or rental of supplies, materials or equipment, or any other part of the Work, will require that the subcontractor or materialman be bound by and subject to all of the terms and conditions of the Contract. No subcontract or order will relieve Seller from its obligations to Company, including, but not limited to Seller's insurance and indemnification obligations. No subcontract or order will bind Company.

Section 23. Environment, Health, Safety and Security.

(A) Seller and any Subcontractors agree to comply with Company's rules and regulations, including its environmental, health, safety and security rules and

regulations, when performing any Work for Company. Upon request of Company, and at no cost or expense to Company, Seller shall promptly remove from said premises any person under the control of Seller who violates any of the aforesaid health, safety and environmental or plant laws, regulations, ordinances or rules or who may cause or threaten to cause a breach of the peace, or who is otherwise objectionable to Company.

(B) Seller will not introduce to the Premises or the Work site any Hazardous Substances without the prior written approval of Company. For any goods or materials furnished in accordance with the Contract which are defined as Hazardous Substances under Applicable Environmental Laws, Seller will provide Company with warning and safe handling information in the form of a material safety data sheet (MSDS) and appropriate labeling for such goods and materials. Unless approved in writing by Company's location manager prior to shipment, Seller will not deliver any goods containing asbestos in a content exceeding the local regulatory level or 1% by weight of the good, whichever is less.

Section 24. Cleaning.

Seller will at all times keep the Work site and the adjoining premises, driveways, and streets clean of rubbish caused by Seller's operations and, at the completion of the Work, will remove all rubbish and all of its tools, equipment, temporary work, and surplus material and will have the Work clean and ready for use. If Seller does not attend to such cleaning immediately upon request, Company may cause such cleaning to be done by others and charge the cost to Seller.

Section 25. Title and Risk of Loss.

Each item of Equipment shall, to the extent consistent with applicable laws, become the property of the Company at whichever is the earlier of the following times, free from liens and other encumbrances:

- (1) when it is delivered FOB (port of shipment); or
- (2) when the Seller receives payment of the value of the Equipment.

Risk of loss of or damage to each item of Equipment shall pass in accordance with the applicable Incoterm set forth in the Contract. However, Seller will be liable for any loss or damage to the Equipment caused by Seller or its Subcontractors, their agents or employees.

Section 26. Indemnification.

(A) "Indemnitees" means Company, its parents, affiliates and its and their directors, officers, employees, agents, successors and assigns. Seller agrees to indemnify, defend and hold harmless Indemnitees from and against all liabilities, expenses, suits, actions, claims, demands, judgments, settlements, costs, losses, damages

and all other obligations and proceedings, including without limitation all judgments rendered against, and all fines and penalties imposed upon, Indemnitees and all attorney fees and any other costs of litigation incurred (collectively "Liabilities") which Indemnitees may suffer, incur, become responsible for or pay out as a result of or in any manner connected with:

- (1) Failure by Seller to comply with any law, ordinance, regulation, rule or order, or with this Contract. This Section 26 includes, but is not limited to, fines or penalties by government authorities and claims arising from Seller's actual or asserted failure to pay taxes.
- (2) personal injury, including death, or property loss or damage, or any other loss or damage, to Company or to others (including Seller and employees and invitees of Seller and of Company) arising out of or in any manner connected with (i) the performance, production and/or delivery of, or any defect in, Work supplied or purchased hereunder, (ii) any act or omission of Seller, and/or (iii) breach of any representation, warranty or covenant, whether caused by Seller, or a supplier of Seller, or employees or invitees of either of them, and in each case whether or not caused or contributed to by the fault or negligence of any of the Indemnitees. Seller's defense and indemnity obligations hereunder include claims and damages arising from non-delegable duties of Company or arising from use by Seller of construction, equipment, tools, scaffolding or facilities furnished to Seller by Company.
- (3) Contamination, pollution, or public or private nuisance arising directly or indirectly out of this Contract or out of any acts or omissions by Seller, its suppliers or sub-suppliers.
- (4) Damage to Company's property while such property is in Seller's custody or control, pursuant to Section 34.
- (B) Seller's defense and indemnity obligations shall apply regardless of whether the party to be indemnified was concurrently negligent, whether active or passively, excepting only where the injury, loss or damage was caused solely by the negligence or willful misconduct of, or by defects in design furnished by, the party to be indemnified. Seller's defense and indemnity obligations shall include the duty to reimburse any attorneys' fees and expenses incurred by Company for legal action to enforce Seller's indemnity obligations. For the avoidance of doubt, Seller expressly agrees that Seller will indemnify, defend and hold harmless the Indemnitees in connection with this Section 26 even if any of all of the Liabilities incurred by any or all of the Indemnitees are caused in part by the concurrent negligence of one or more of the Indemnitees. Seller waives the application of the doctrine of comparative negligence and other doctrines that may otherwise allocate the liability covered by Seller's indemnity. Seller agrees to waive and release any rights of contribution, indemnity or subrogation it may have against

any of the Indemnitees as a result of any indemnity claim asserted by another Indemnitee under this Section 26.

- (C) In the event that any indemnity provisions contained herein are contrary to the law governing this document, then the indemnity obligations applicable hereunder shall be construed to apply to the fullest extent allowed by applicable law.
- (D) Seller, for itself, its successors, assigns and subcontractors hereby expressly agrees to waive any provision of any workers' compensation act or other similar law whereby Seller could preclude its joinder by Company as an additional defendant, or avoid liability for damages, contribution or indemnity in any action at law, or otherwise where Seller's or its subcontractor's employee or employees, heirs, assigns or anyone otherwise entitled to receive damages by reason of injury or death brings an action at law against any Indemnitee. Seller's obligation to Company herein will not be limited by any limitation on the amount or type of damages, benefits or compensation payable by or for Seller under any workers' compensation acts, disability benefit acts, or other employee benefit acts on account of claims against Company by an employee of Seller or anyone employed directly or indirectly by Seller or anyone for whose acts Seller may be liable. In particular, but without altering or in any way limiting the general application of such waiver as set forth in the previous sentence, Seller expressly waives application of Section 303(b) of the Pennsylvania Workers' Compensation Act and Section 35. Article II of the Ohio Constitution and Ohio Revised Code Section 4123.74, each as may be amended from time to time. The obligations in this Section are in addition to Seller's duty to provide insurance and will not be altered by any limitation on the amount or type of damages, compensation, or benefits payable by Seller under any Workers' Compensation Act, U.S. Longshoremen's and Harbor Workers' Act, or any other employee benefit act. Seller's obligations hereunder will not be limited to the extent of any insurance available to or provided by Seller.

Section 27. Insurance.

Seller agrees: (i) to maintain in full force and effect casualty, property, and other lines of insurance of the types, including but not limited to insurance for professional liability, cyber security liability, and environmental liability, where applicable, on the terms and in the amounts commensurate with its business and risks associated therewith ("Insurance") and to comply with applicable workers compensation insurance laws regarding insurance or qualification as a self-insurer; (ii) to the extent permitted by law, to waive rights of subrogation and contribution against Company, including Company as an additional insured, under policies of Insurance; (iii) to ensure that Company is made an additional insured on policies of Insurance under terms of coverage customary to the risk of loss to which Company is exposed and that the limits of Insurance to which Company is entitled as an additional insured are no less than the amount of total limits of Insurance applicable to Seller under all of the policies of Insurance; (iv) to ensure that the policies of Insurance are stated to be specifically primary to any of Company's insurance policies, which

policies shall be, in all respects, excess to Seller's policies of Insurance; (v) to be solely responsible for any deductibles, self-insured retentions, or other form of self-insurance under the policies of Insurance; (vi) upon Company's request, to timely provide written certification, reasonably acceptable to Company, certifying the material terms of the policies of Insurance.

Section 28. Liens.

Seller guarantees that Seller, or anyone claiming under or through Seller such as, subcontractors, and materialmen will not make, file, or maintain a mechanic's or other lien or claim of any kind or character against any building or other structure to which the Contract relates, the additions, improvements, alterations, or repairs made on such buildings or other structures, the ground on which said building or other structure is situated, or any other property or property interest owned, held, occupied, or otherwise possessed by Company, for or on account of any labor, materials, fixtures, tools, machinery, equipment, or any other things furnished, or any other work done or performance given under, arising out of, or in any manner connected with the Contract, or any agreement supplemental to the Contract (such liens or claims referred to as "Claims"); and Seller, subcontractor, and materialmen expressly waive and relinquish any and all rights which they now have, or may subsequently acquire, to file or maintain any Claim and Seller, subcontractor, and materialmen agree that this provision waiving the right of Claims will be an independent covenant.

Section 29. Intellectual Property Indemnification.

Seller will indemnify, protect, defend or settle (at Seller's expense) and hold harmless Indemnitees from all Liabilities incurred as a result of actual or alleged infringement of any

present or future or actual or alleged intellectual property right of any third party arising from

Company's purchase or use of Work supplied under this Contract. In the event of an allegation of intellectual property infringement or if the use or sale of the Work is enjoined, Seller will, at its own expense and at Company's option, either (i) procure the right to continue

using the Work; (ii) make such alterations, modifications or adjustments to the Work so that they become non-infringing without incurring a material diminution in performance or

function; (iii) replace same with a non-infringing equivalent; or (iv) refund the purchase price.

All such obligations of Seller to indemnify, hold harmless, protect and defend Company

addition to Seller's warranty obligations and all other rights or remedies of Company and will

survive acceptance and use of, and payment for, the Work, and completion, termination, or

cancellation of this Contract. If any settlement requires an affirmative obligation (other than

ceasing use of the Work) of, results in any ongoing liability to or prejudice or detrimentally impacts Company in any material way, then such settlement shall require Company's written

consent and Company may have its own counsel in attendance at all proceedings and substantive

negotiations relating to such Liabilities.

Section 30. Assignment.

Neither this Contract, nor Seller's rights and obligations hereunder, are assignable without the prior written consent of Company. No such consent or assignment will release Seller or alter Seller's liability to perform its obligations under this Contract. Any attempted assignment without the prior written consent of Company will be null and void.

Section 31. Termination of Contract by Company.

- (A) Should Seller at any time refuse or fail to prosecute the Work with promptness and diligence, or to perform any of its other obligations under the Contract, Company may terminate Seller's right to proceed with the Work by written notice to Seller. In such event Company may enter upon the Work site and finish the Work by whatever method it may deem expedient, including the hiring of another contractor or other contractors and, for that purpose, may take possession of all materials, machinery, equipment, tools, and appliances and exercise all rights, options, and privileges of Seller. In such case Seller will not be entitled to receive any further payments until the Work is finished. If the unpaid balance of the Contract price exceeds Company's cost of finishing the Work, including compensation for additional managerial and administrative services, such excess will be paid to Seller. If such Company's cost will exceed such unpaid balance, Seller will be liable for and will pay the difference to Company.
- (B) Company may, for its own convenience, terminate Seller's right to proceed with any portion or all of the Work by written notice to Seller. Such termination will be effective in the manner specified in such notice, will be without prejudice to any claims which Company may have against Seller, and will not affect the obligations and duties of Seller under the Contract with respect to portions of the Work not terminated.
- (C) On receipt of notice under Section 31(B), Seller will, with respect to the portion of the Work terminated, unless the notice states otherwise,
 - (1) immediately discontinue such portion of the Work and the placing of orders for materials, facilities, and supplies in connection with the performance of the Work; and

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- (2) complete only such portions of the Work which Company deems necessary to preserve and protect those portions of the Work already in progress and to protect material, plant, and equipment at the Work site or in transit to the Work site.
- (D) Upon termination pursuant to Section 31(B), Seller will be paid a pro rata portion of the compensation in the Contract for any portion of the terminated Work already performed. Upon determination of the amount of said pro rata compensation, Company will promptly pay such amount to Seller upon delivery by Seller of the releases of liens and affidavit, pursuant to Section 14(C).

Section 32. Confidentiality.

- (A) All data and other information of every kind, whether expressed in writing or otherwise, disclosed or revealed at any time to Seller by Company or any of its parents, subsidiaries, affiliates, customers and contractors, learned at any time by Seller by observing Company's facilities, or made or developed by Seller in the course of performing the Work for Company under this Contract (all called "Information"), regardless of whether it is identified as "confidential", will be:
 - (1) received and maintained in strict confidence by Seller and will not be disclosed, directly or indirectly, by Seller to any related or unrelated party whatsoever; and
 - (2) used by Seller only for the performance of the Work for Company.

Any description of the Work including that set forth in this Contract will, unless otherwise specified, be considered Information.

- (B) The foregoing obligations of confidentiality, limited use and non-disclosure will not apply to the following three exclusions:
 - (1) Information which was known to Seller and reduced to writing or other document form by Seller prior to the date of this Contract, and which was not first acquired, directly or indirectly, from Company; or
 - (2) Information which is or becomes available in issued patents, published patent applications or printed publications of general public circulation other than by acts or omissions of Seller; or
 - (3) Information which Seller after the date of this Contract lawfully obtains without restriction from a third party other than from a third party who obtained such Information from Company.

Notwithstanding the fact that any of the above exclusions apply to any part of Information covered by this Section 32, Seller may not, without the express written approval of Company, directly or indirectly, expressly or impliedly, reveal to any third party, Company's interest in or opinion of any such Information nor reveal Company as a source of such Information. Seller may not reveal to any party whatsoever without Company's express written approval that Seller is performing services for Company or the character of such services. Seller will immediately notify Company of any disclosure of Information that is not permitted by this Contract and will be responsible for the disclosure or other misuse of Information.

If Seller believes that any of the exclusions set forth in Subsections 32(B)(1), (2) or (3) apply with respect to certain Information so as to permit disclosure to a third party or use beyond that specified in this Section 32, Seller will first give notice to Company of such belief, specifying the facts upon which such belief is based. Such notice will include specific reference to documents and other writings relied upon by Seller for claiming that an exclusion applies to said Information. Specific Information will not be deemed to be within said exclusions merely because it is embraced by general information within such exclusions nor will a combination of features be deemed within such exclusions merely because the individual features of such combination are separately within such exclusions. Seller will, upon the reasonable request of Company, furnish such available additional information as may be reasonably requested by Company in its evaluation of the validity of the said claim.

- (C) Seller will do the following as part of Seller's compliance with the obligations of confidentiality, limited use and non-disclosure:
 - (1) Seller may reveal Information only to Seller's employees, but only when and to the extent necessary for Seller to perform the Work requested by Company, and Seller will advise all such employees to whom Information is disclosed of the obligations imposed on Seller.
 - (2) Seller will maintain all documents or other media (including computer programs or software) which contain Information, and all copies of the documents or other media, in a secure location inaccessible to third parties and others not authorized to receive Information.
 - (3) All writings, drawings, pictures or other documents or other media, including all copies, which contain Information, will be marked by Seller with the legend "Confidential Property of Alcoa USA Corp." or "Confidential Property of (name of subsidiary or affiliate of Alcoa USA Corp.)" as the case may be, if they are not already so marked and Seller will not reproduce, copy or photograph any such document or other medium without the prior written approval of Company. Seller will deliver to Company all documents, media or tangible property made or received by Seller which contain Information upon notice from Company

requesting the delivery of such documents, media or other tangible property.

- (D) Seller will take the following safeguards for all tangibles as may be provided to Seller, or made by Seller pursuant to this Contract including all products, compositions, machines, equipment, constructions, apparatus, process embodiments, metal or other work stock, tools, dies or other goods or materials:
 - (1) maintain and hold such tangibles in a secure area and separate from materials and goods for other parties.
 - (2) use such tangibles only to render the Work to Company as requested by Company.
 - (3) prevent observation of such tangibles by visitors to Seller's premises or by Seller's employees, officers, agents and directors who do not have a need to observe such in order for Seller to perform the Work for Company.
 - (4) maintain such tangibles in the exclusive possession of Seller and not permit such or samples of such tangibles to leave its possession at any time, except with the express (and not implied) written approval of Company.
- (E) Company makes no representation or warranty of any kind, express or implied, with respect to any Information. Company may, at its sole discretion, elect at any time, by written notice to Seller, terminate Seller's further use of Information and Seller shall immediately return to Company all Information and copies thereof, and erase any digitally held Information. Termination by Company will not affect Seller's continuing obligations in this Section 32.
- (F) The obligations imposed by this Section 32 will continue in effect for a period of ten years from the date on which the Work was last performed by Seller for Company, and will survive any termination of this Contract by either party.
- (G) Company will have an unlimited right to publish, use, duplicate or disclose Information and all copyrights in Information will be the sole and exclusive property of Company.
- (H) Seller will enter into agreements to effectuate the provisions of this Section 32 with all persons who perform any part of the Work for Company prior to any such performance, and a copy of said agreements will be provided to Company by Seller if requested by Company.

Section 33. Export of Information.

Notwithstanding any other provision or understanding between Company and Seller, Seller will not at any time whatsoever or under any circumstances whatsoever disclose or reveal any Information to any person not a United States citizen and resident, or to any person outside the United States, or to any person within the United States for export outside the United States or to any representative of a foreign national or foreign interest or in any manner export any Information from the United States when to do so would be contrary to or in violation of any law or regulation of the United States or any agency of the United States, including laws and regulations concerning export of data and information. Even after expiration of this Contract and the confidentiality term specified in Section 32(F), Seller may not export any Information or disclose any Information to any such above-mentioned person until Seller has procured the licenses, assurances and approvals, if any, necessary under such laws or regulations.

Seller represents and warrants that it will not export, directly or indirectly, any technology, software or commodities of U.S. origin or having U.S. content provided by Company or their direct product to any of the countries or to nationals of those countries, wherever located, listed in U.S. Export Administration Regulations, as modified from time to time, unless authorized by appropriate government license or regulations.

Section 34. Ownership of Materials and Goods.

All products, compositions, constructions, machines, equipment, apparatus, processes or other goods or materials, including metal or other work stock and tools and dies as may be provided to Seller by Company for performance of the Work or made by Seller pursuant to this Contract, will be the sole and exclusive property of Company and will be used only for performance of the Work, without modification or alteration, except as reasonably necessary or appropriate to the performance of the Work and, upon Company's request, will be delivered by Seller to Company. All Company property, while in Seller's custody or control, will be held at Seller's risk, free of all liens, encumbrances or security interests of Seller or third parties, and will be kept insured by Seller at Seller's expense in an amount equal to replacement cost with loss payable to Company. Seller will indemnify, protect, defend and hold harmless Company, its successors and assigns from and against all claims and liens adverse to Company's ownership of Company's property and all loss or damage to such property occurring while in Seller's custody or control. All property of the Company is subject to removal by Company at any time, and to return upon Company's request. Seller will assume all risk of death or injury to persons or damage to property arising from use of Company's property. Company does not guarantee the accuracy of any Company property or the availability or suitability of any property furnished by it. Seller assumes sole responsibility for inspecting, testing and approving all of Company's property supplied by Company prior to any use by Seller.

Section 35. Publicity.

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No advertising or publicity matter having or containing any reference to Company or to the subject matter or existence of this Contract or in which the name of Company is

mentioned will be made by or for Seller without obtaining written approval from Company. Seller may not use the Company's name and/or logo in any manner other than as may be identified in this Contract without first obtaining written permission from Company.

Section 36. Exclusion of Certain Persons.

Seller, at its own expense, will have background and credit checks performed on each employee that it plans to assign to work on Company's premises. Seller will comply with all applicable C-TPAT security criteria as issued and updated by the U.S. Customs and Border Protection Agency from time to time. Seller will provide Company with documentation of such compliance upon request. Seller will not, without the prior written consent of Company, permit any person other than officers, employees, or representatives of Company, Seller, or its subcontractors to enter upon the Premises. Seller will not, without the consent of Company, knowingly employ upon the Premises, any person who is a member of or associated with any organization designated by the United States Attorney General as having interest in conflict with those of the United States, any person alleged to be in violation of any applicable foreign, federal, state or local law or regulation, or any person whose character is such that his presence on the Premises might obviously be detrimental to Company's interests. Company will have the right to bar or remove from its Premises any such individual after appropriate notice has been given to Seller.

Section 37. No Violation of Law.

Seller and the Work will comply with all applicable foreign, federal, state and local laws, rules, regulations, orders, conventions, ordinances or standards including, but not limited to, those relating to environmental matters, data protection and privacy, wages, hours and conditions of employment, subcontractor selection, discrimination, occupational health/safety and motor vehicle safety. Unless this Contract is otherwise exempted by law, Seller will comply with Executive Order 11246, as amended by Executive Order 11375 (Equal Employment Opportunity) the Rehabilitation Action of 1973, the Vietnam Era Veteran's Readjustment Assistance Act of 1974 and the Americans with Disabilities Act, as they have been or may be amended from time to time, and regulations implementing such statutes; and any similar state and local laws and ordinances and the regulations implementing such statutes. Seller warrants that the Work delivered hereunder were produced at facilities complying with all applicable provisions of the Occupational Safety and Health Act and applicable regulations under that Act. Seller further warrants that it will comply, where applicable, and without limitation, with all orders, standards, and regulations of the pertinent governmental administrations. Seller and subcontractor shall abide by the requirements of 41 CFR §§ 60-1.4(a), 60-300.5(a) and 60-741.5(a). These regulations prohibit discrimination against qualified individuals based on their status as protected veterans or individuals with disabilities, and prohibit discrimination against all individuals based on their race, color, religion, sex, or national origin. Moreover, these regulations require that covered prime contractors and subcontractors take affirmative action to employ and advance in employment individuals

without regard to race, color, religion, sex, national origin, protected veteran status or disability.

Section 38. Electronic Commerce.

Seller acknowledges that Company currently uses, or will in the future use, an electronic "business to business" framework to facilitate the transmission of Key Documentation relating to the purchase of Work hereunder. For purposes of this provision "Key Documentation" means purchase orders, order confirmations, advanced shipping notices (ASN), change orders, invoices and other similar documentation which form a part of the Contract. Seller acknowledges and agrees that (i) it has in place currently, or will implement as soon as possible after execution hereof, the system designated by Company to facilitate transmission of Key Documentation electronically, and (ii) Key Documentation transmitted hereunder by such methods will not be deemed invalid solely because they have been transmitted or executed electronically. To the extent required by Company, each authorized representative of a party will adopt a unique, verifiable digital identification consisting of symbols or codes to be transmitted with each electronic transmission and use of such digital identification will be deemed for all purposes to constitute a "signature" and will have the same effect as a signature on a written document.

Section 39. Import/Export Compliance.

If any Work is to be delivered into any other country, Seller will be responsible for strict compliance with all legal, regulatory and administrative requirements associated with any importation or exportation of such Work, including obtaining any required licenses or approvals and the payment of all associated duties, taxes and fees.

Section 40. Limitation on Use of Payment.

Seller shall not offer or use, directly or indirectly, any money, property or thing of value received by Seller under or pursuant to this Contract to influence improperly or unlawfully any decision, judgment, action or inaction of any official, employee or representative of any government or agency or instrumentality thereof, or of any government owned or partially government owned entity, or any other person or entity, in connection with or relating to the subject matter of this Contract or any supplement or amendment hereto. No payment shall be made nor shall any transaction be entered into in connection with this Contract that is illegal, improper or is intended to unduly or improperly influence any third party, including without limitation, by means of extortion, any kickback or bribery. If Seller breaches the terms of this provision, Company may immediately terminate this Contract without any liability.

Section 41. Transition of Supply.

In connection with termination of this Contract or Company's decision to change to an alternate provider of the Work, Seller will cooperate in such transition, including the following (collectively, "Transition Support"): (a) Seller will continue delivery of all Work as ordered by Company, at the prices and other terms stated in this Contract, without

premium or other condition, during the entire period reasonably needed by Company to complete the transition to the alternate supplier(s), such that Seller's action or inaction causes no interruption in Company's ability to obtain Work as needed; and (b) subject to Seller's reasonable capacity constraints, Seller will provide special services as expressly requested by Company in writing. If the transition occurs for reasons other than Seller's breach, Company will, at the end of the transition period, pay the reasonable, actual cost of Transition Support as requested and incurred, provided that Seller has advised Company of its estimate of such amounts and obtained Company's prior written consent prior to incurring such amounts. Any costs incurred by Seller without Company's prior written consent shall be for Seller's account.

Section 42. Force Majeure.

- (A) Neither party will be in default for any delay or failure to perform its obligations under this Contract if caused by an unforeseen supervening circumstance not within the contemplation of the parties at the time of contracting, beyond its reasonable control and without its fault or negligence ("Force Majeure") provided that any delay or failure to perform caused by default of a supplier of Seller at any lower tier must be beyond the reasonable control of both Seller and such supplier without the fault or negligence of either and goods or services to be furnished must not be obtainable from other sources in sufficient time to permit Seller to meet the delivery schedule. For the avoidance of doubt, Force Majeure will not include strike or lockout by the Seller's Personnel or other employees of the Seller or its subcontractor.
- (B) If a party is or will be prevented from performing any of its obligations under the Contract by Force Majeure, then it must give notice to the other party of the event or circumstances constituting the Force Majeure and will specify the obligations, the performance of which is or will be prevented. The notice must be given within 7 days after the party became aware, or should have become aware, of the relevant event or circumstance constituting Force Majeure.
- (C) Upon the occurrence of any circumstances of Force Majeure the Seller will endeavor to continue to perform its obligations under the Contract so far as reasonably practical. The Seller shall notify the Company of the steps it proposes to take, including any reasonable alternative means for performance which are not prevented by Force Majeure. The parties shall at all times use reasonable endeavors to minimize any delay in the performance of the Contract as a result of Force Majeure.
- (D) If the Seller is prevented from performing any of its obligations under the Contract by Force Majeure and suffers delay by reason of such Force Majeure, Seller shall be entitled to an extension of time for any such delay, if completion of the design, engineering and delivery of all of the Equipment by the relevant Milestone Date or the Time for Completion (as the case may be) is or will be delayed, but shall not be entitled to any adjustment to the Contract Price or any additional cost. Seller must provide Company

with written notice within 28 days after Seller becomes aware, or should have become aware, of the impact on the Milestone Date or the Time for Completion (as the case may be).

(E) If the execution of substantially all of the Services in progress is prevented for a continuous period of 180 days by reason of Force Majeure, or for multiple periods which total more than 360 days due to the same Force Majeure, then either party may give the other party notice of termination of the Contract. Upon such termination, Company shall pay to Seller the value of Services performed up to the date of termination and completed Equipment which has yet to be delivered to Company. The Equipment and any Contractor Documents will become the property of the Company when paid for by the Company and the Seller shall place the same at the Company's disposal.

Section 43. Audit Rights

Seller will keep full and detailed accounts and records as may be necessary to reflect the actual cost of all Work performed and these records will be subject to audit by the Company upon prior notice to the Seller.

Section 44. Data Privacy

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(A) Seller warrants and undertakes that Seller's processes, services and treatment of all personal data that it may receive, access and/or process on behalf of Company (and/or Company's employees, customers or suppliers) complies with the applicable laws of all states and countries regarding personal data, including but not limited to the U.S. Department of Commerce Safe Harbor Guidelines ("Guidelines"), the Australian Privacy Principles as prescribed by the Privacy Act 1988 ("Principles") and/or the European Data Protection Directive (95/46/EC) ("Directive") (as amended and collectively, "Privacy Laws") and that Seller shall use best efforts to comply at all times with such Privacy

Laws. If applicable, Seller agrees to execute a data processing agreement with Company to ensure ongoing privacy protection for individuals. If Seller fails to comply with any of the Privacy Laws, Company will have the option to terminate this Contract immediately without further liability. Seller shall act solely on the instructions of Company regarding all personal data (unless prohibited by the Privacy Laws). Seller will notify Company immediately in writing of any: (i) actual or suspected breach of this Section 44; and (ii) of any complaint or request by any individual concerning personal data or relating to

Company's obligations under any of the Privacy Laws. Seller will provide full cooperation and assistance to Company regarding any such complaint or request. Seller shall, upon completion of Services, destroy or return all personal data to Company with all other media or document where any personal data is maintained.

- (B) Seller warrants and undertakes that it will ensure that its employees, agents and subcontractors comply with all applicable Privacy Laws regarding the receipt and/or processing of personal data.
- (C) If Seller violates any obligations in this Section 44, the applicable data processing agreement or the Privacy Laws in any manner, Seller shall take all necessary measures required by the local laws of each individual affected by the unauthorized disclosure.
- (D) Seller will conduct audits to ensure compliance with its obligations under this Section 44 and will permit Company (or its designee), upon reasonable notice, access to Seller's facilities, procedures and other operational data and information for purposes of reviewing records and materials and auditing Seller's compliance with this Contract.
- By submitting business contact and personal information about Seller and/or its (E) employees to Company, Seller consents to the collection, processing, storage, use transfer of that information to/by Company and all its controlled entities, and subsidiaries in the United States of America and elsewhere and their affiliates and party contractors or agents for the purpose of: facilitating Seller's authorized thirdwith Company, enhancing Company's ability to contact business relationship Seller and its employees, and enabling Company to process and track Seller's transactions with Company through various internal systems and external third parties ("Purpose"). Company shall use the information supplied solely for the Purpose and shall store the data for as long as is strictly necessary to be able to complete the Purpose.

Section 45. Conflict Minerals

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Any goods to be supplied by Seller to Company that contain conflict minerals as defined by Section 1502 of the Dodd-Frank Wall Street Reform and Consumer Protection Act (Act) and U.S. Securities and Exchange Commission regulations implementing the Act (Rule) will only come from sources that are not known by Seller, after due inquiry, to directly or indirectly finance or benefit armed groups or conflict, including in the Democratic Republic of the Congo or any adjoining country. Seller agrees to: cooperate with Company in conducting any due diligence in accordance with the Rule; comply with reasonable requests for information in order to facilitate compliance with the Rule and any other similar law, rule or regulation currently in place or adopted in the future; and maintain records related to the Rule.

Section 46. Liquidated Damages for Delay

Unless otherwise provided in the Contract, if Seller fails to deliver the Equipment on or before the delivery date specified in the Contract, Seller shall pay delay liquidated damages to Company at the rate set forth in the Special Conditions of Contract. Delay liquidated damages shall be paid at such rates for the period from the delivery date until

the date on which the Equipment is actually delivered. The parties agree that the delay liquidated damages set out in this Contract are a genuine, fair and reasonable pre-estimate of the actual damages that will be suffered by the Company as a result of a failure to deliverer the Equipment on the date(s) specified in the Contract and do not constitute a penalty. The payment by the Seller of delay liquidated damages pursuant to the Contract shall not relieve the Seller from its obligations to complete the Work in accordance with the Contract, nor from any other duties, obligations or liabilities under the Contract. Nothing in this clause shall operate to restrict any other rights and remedies to Company at law or under this Contract.

Section 47. Supplier Standards.

Seller acknowledges that it has access to, has read and understands Company's standards of conduct as set forth in Alcoa Supplier Standards (the "Guide") as published at http://www.alcoa.com/global/en/who-we-are/ethics-compliance/pdf/Supplier_Standards.pdf.

Section 48. Merger and Modification.

This Contract is intended to be the complete, exclusive, and fully integrated statement of the parties' agreement regarding the Work. As such, it is the sole repository of the parties' agreement, and they are not bound by any other agreements, promises, or representations of whatsoever kind or nature. The parties also intend that this complete, exclusive and fully integrated statement of their agreement may not be supplemented or explained (interpreted) by any evidence of trade usage or course of dealing. This Contract may not be modified except by a writing signed by the parties. Regardless of the work performed by Seller, the Seller's compensation shall not exceed the maximum set forth in the purchase order without a writing expressly authorizing the increase signed by Company.

Nothing in this Contract, express or implied, is intended or may be construed to confer upon any person other than the parties to this Contract any right, remedy or claim under or by reason of this Contract.

Section 49. Anti-Waiver.

No term or provision of this Contract shall be deemed waived, and no breach excused, unless such waiver or consent is in writing and signed by the party claimed to have provided such waiver or consent. No waiver of any right shall constitute a waiver of any other right, whether of a similar nature or otherwise.

If any provision of this Contract or its application to any person or circumstance is adjudged invalid or unenforceable by a court of competent jurisdiction, then the remainder of this Contract or the application of such provision to other persons or circumstances will not be affected by such adjudication. If any provision or application of this Contract is invalid or unenforceable, then a suitable and equitable provision will be substituted for such provision in order to carry out, so far as may be valid and

enforceable, the intent and purpose of this Contract, including the invalid or unenforceable provision.

Section 50. Survival.

Notwithstanding the expiration, termination, or cancellation of this Contract, it is agreed that those rights and obligations which by their nature and context are intended to survive such expiration or termination will survive beyond such expiration, termination, or cancellation.

Section 51. Choice of Law and Choice of Forum.

Any and all claims or matters of dispute between the parties to this Contract, whether arising from the Contract itself or arising from alleged extra-contractual facts or incidents, including, without limitation, fraud, misrepresentation, negligence or any other alleged tort or any breach of the Contract, shall be resolved, governed by, construed, and enforced in accordance with the laws of the State of Delaware, regardless of the legal theory upon which such matters are asserted, including Delaware's statutes of limitations but not including its choice of laws rules. The application of the United Nations Convention on Contracts for the International Sale of Goods ("CISG") is hereby expressly excluded. Any and all claims or matters of dispute referenced in this paragraph shall be resolved in a court of competent jurisdiction in Wilmington, Delaware which courts shall have exclusive jurisdiction of all such disputes. Seller waives any and all objections that it might otherwise have as to personal jurisdiction or venue in such courts.

Gov. Contract# Priority Rating#

Ship Via Freight Terms FOB
Freight Collect Destination-TitleTransfer

Payment Terms Currency

NET 30 DAYS USD

Alcoa requires suppliers to utilize the BestTransport Supplier Connection Portal for shipments meeting the conditions set forth below:

Supplier Criteria for using BestTransport Supplier Connection

- * Alcoa Corporation responsible for freight payment to the carrier.
- * For shipments within North America (excluding inter and intra Mexico)
- * For single shipments weighing 150 lbs. or more
- * For motor carrier service shipped as Van, Flat Bed, or LTL.

Alcoa suppliers are to register with BestTransport Supplier Connection at http://supplier.bestshippers.com. To register, click on the Create Account button and enter the Alcoa account key 4alcoa (the key is case sensitive) and click the Submit button.

For assistance creating an account, entering shipment information, or shipment questions or problems, suppliers should contact Alcoa Central Dispatch at 1-866-209-3737 option 6 or via email at AlcoaCorpCD@alcoa.com. For assistance in French, contact the Transportation Group at 1-819-294-3036 or by email at DL-NerDepartementTransport@alcoa.com.

BestTransport Supplier Connection SHOULD NOT be used for urgent, over-dimensional, or any other shipment that requires special handling. Please contact Alcoa Central Dispatch or the Transportation Group for assistance.

Shipments weighing less than 150 lbs. with a destination in the United States are to be routed directly using Fed Ex Small Package, referencing the appropriate Alcoa Shipper Account Number. Shipments weighing less than 150 lbs. with a destination in Canada are to be routed directly using UPS Small Package, referencing the appropriate Alcoa Shipper Account Number.

PLEASE CONFIRM THIS PURCHASE ORDER TO USBuyandPaymentCenterGPP&ATC@alcoa.com In order to avoid short payment issues, please do not ship until you receive a revised PO. Our system does not allow us to update the price on POs after a receipt has been entered.

CHANGE ORDER

ALCOA CORPORATION

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 A CAPITAL

Supplier GILLESPIE & POWERS INC

PRICING

Please review this Purchase Order carefully. If prices, quantities, part numbers, and/or descriptions are not accurate, please contact the BUYER OF RECORD immediately.

TAX

DO NOT charge state sales/excise/use tax as these purchases are direct pay under Indiana Authorization # 0158155386-001

RECEIVING HOURS

Warrick Operations: Monday through Friday, 7:00am thru 1:30PM CST (unless otherwise instructed).

SHIPMENTS

Please also review shipping instructions listed above.

- 1. Shipment and paperwork must be marked with the Purchase Order number and Company name.
- Packing list must be included and placed on outside of package.
- 2. For FEDEX shipments:

Warrick Operations: Bill to Alcoa account number: ***** 742696383 ***** Billing zip code: 47630.

- 3. Direct any collect freight bills to: Alcoa, C/O IPS World Wide, PO Box 982262, El Paso, TX 799982
- 4. Shipments must be CONEG compliant. Supplier assures all materials purchased for use in packaging comply with the CONEG Model Legislation regarding heavy metals in packaging materials.
- 5. FDA PACKAGING; In the case where this material is to be used in packaging of articles or materials that will come in contact with food, acceptance of this order is conditioned on your assurance that the material covered herein is of suitable purity to be used in packaging and protecting articles or materials which come in contact with food.
- 6. Supplier shall not make any shipment containing loose Polystyrene Packing Material.
- 7. Shipments containing wood packaging material imported into the USA must comply with 7 CFR 319.40, Importation of Wood Packaging Material, Effective 9-16-05.
- 8. ¿ AŠBĚSTOS: ALCOA CORP WILL NOT ACCEPT ANY MATERIAL CONTAINING ASBESTOS. IT IS UP TO THE SUPPLIER TO ASSURE THAT NO PRODUCT FURNISHED TO ALCOA CONTAINS ASBESTOS. ¿

QUALITY REQUIREMENTS

- 1. System Requirements The supplier's quality system shall comply, at a minimum, with the requirements of ISO 9001 (current revision). The supplier's quality system shall be available at all times for review and approval by Alcoa Corp personnel.
- 2. Substitution of Material / Subcontracting Material or service Supplying substitute material or service or subcontracting of any portion of this work is not permitted unless approved by Alcoa in writing.
- 3. Changes The supplier must notify Alcoa Corp prior to making any significant change(s) to the process or product. This notification must include information regarding the expected performance difference(s) in the material or process due to the proposed change(s). Alcoa Corp reserves the right to require qualification material be supplied to verify process impact prior to receipt of order quantities.
- 4. Right of Access For quality audit purposes, Alcoa Corp, Alcoa Corp's customer and regulatory agencies will have access to approved supplier's facilities including subcontractor facilities with appropriate notifications for the purpose of verifying the quality of the product or service. This includes access to all facilities involved in this order and all applicable quality records including those of the calibration system.
- 5. Record Retention (General) Supplier must maintain all quality records relating to the production/processing of this order for a minimum of 7 years after the material has been shipped. If this requirement cannot be met, the quality records must be transferred to Alcoa Corp at the completion of the work.
- 6. Non-Conforming or Discrepant Material If material delivered to Alcoa Corp is found to be non-conforming, supplier must provide all necessary information for traceability purposes and obtain, in writing from Alcoa Corp Procurement, acceptance or rejection of the material. When a corrective action is deemed necessary, the supplier will receive a corrective action request (CAR) form. The supplier must provide a written response within 14 working days documenting root cause, corrective actions taken, effective date and signature of quality assurance representative. Delinquency on or no response to corrective action requests may cause reevaluation of supplier's quality system's approval and may preclude issuance of new purchase orders/contracts.

MATERIAL SAFETY DATA SHEETS (MSDS)

MSDS must be supplied at the time of the initial shipment of the hazardous material to Alcoa Corp, preferably by mail. MSDS must

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 Revision Date
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Supplier
GILLESPIE & POWERS INC

also be supplied at the time of the next order request after the MSDS has been revised, reviewed, or otherwise modified by the manufacturer.

INVOICING INFORMATION:

Invoices must be submitted to Alcoa following the instructions in the Bill To section of this purchase order.

If the Bill To reads XML Invoice Required, do not submit a paper invoice. Invoices must be submitted using Alcoays B2B solution.

If the Bill To reads NO INV USE ICLAIM, do not submit a paper invoice. Invoice must be submitted using Alcoa¿s SPR (iClaim) system in Alcoa Direct. All supporting documentation must be included with the submission.

If the Bill To reads PFR No Invoice Required, do not submit a paper invoice. Alcoa will generate an invoice based on receipt of goods at the location.

If the Bill To specifies Alcoa¿s invoice email address and PO box, please note that Alcoa prefers paper invoices be submitted via email. Only if email cannot be used should the PO Box be used. Select only one method of transmission.

For all paper invoices, the invoice must include the following on the first page of the invoice:

Purchase order number Invoice number The invoice period The Supplier, s name

The Supplier's remit-to address

At a minimum for Services, supporting documentation must include hours expended, date work was performed, actual name and/or classification of the worker performing the work, rate per hour, extended dollar amount, description of the work, travel & entertainment expenses itemized and including receipts for any expense greater than \$25 USD, supporting documentation for subcontracted services (including actual invoices from the sub-contractors).

Credits must be submitted as a separate credit memo stating the correction to the prior invoice number and reason for the credit. Do not include the credit on the next invoice.

Supplier inquiries about invoice / payment processing should be directed to Customer Support via email at usap@alcoa.com. In addition, Suppliers can check on the status of payments by using http://alcoadirect.com.

US CUSTOMS REASONABLE CARE STANDARDS REQUIREMENT

Itemized invoice and NAFTA certificate of origin (if applicable) must accompany shipment. Documents must contain the following details: purchase order #, model #, Dimension of crate/carton, serial #, weight per piece, description, ship from Location, country of origin, ship to location, ship date, purchase price, expected Delivery date, harmonized tariff #, carton/crate # item packed in, note: we will assist you if you do not know the harmonized tariff number. Contact Amador Cardenas at 865-695-4585 prior to making shipment. The harmonized tariff number must be on the Shipping invoice.

ALCOA¿S IMPORT BROKER CONTACT:

Ocean and Air Imports Livingston International 3625 NW 82nd Ave, suite 107 Miami FL 33166 attn: team 17 alcoaimports@livingstonintl.com

PH: (305) 219-5548 Attn: Carlos Sierra

ALCOA CORPORATION

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Supplier
GILLESPIE & POWERS INC

COUNTRY OF ORIGIN REQUIREMENTS

- 1. Country of Origin Marking: The producer and /or foreign exporter must comply with the U.S. Customs and Border Protection Marking requirements (19 CFR 134- see below) by indicating clearly the country of origin in which the goods were produced on each article and outer package.
- 2. The requirements of 19 U.S.C. 1304 and 19 CFR Part 134 provide that imported articles or their containers must be marked in a conspicuous place as legibly, indelibly and permanently as the nature of the article or container will permit, in such a manner as to indicate to an ultimate purchaser in the United States, the English name of the country of origin of the article.

Order acknowledgement, please sign and return.

Accepting Company:

Title:

Representative (Please Print):

Signature:

Payment schedule in accordance with the commercial proposal.

₋ine#	Item# Description	Rev#	Quantity	UOM	Taxable	Unit Price	Extended Price	Need Date
3					N		708,375.00	29-MAY-20
		ces for the Coated Scrap N Il Proposal R6, Technical F					Addendum Log No	29-MAY-20
Shij	р То							
	Shipment # Address at top of pa	1 age						
	Deliver To : HAYN	NES, TERRY A [Terry.Hayne	es@Alcoa.con	n]			(708.375.00)	
4					N		10,926,225.00	29-MAY-20
1	Down-payment for	GP to order materials for	the Coated S	crap M	elter Proje	ect per attacl	hed Alcoa RFQ R1,	29-MAY-20

Addendum Log No 10, GP Commercial Proposal R6, Technical Proposal R1, and Schedule R2.

Ship To

Shipment # Address at top of page

Deliver To: HAYNES, TERRY A [Terry.Haynes@Alcoa.com]

(10.926.225.00)

Purchase Order Total

11,634,600.00

CHANGE ORDER

Supplie	Supplier GILLESPIE & POWERS INC Line# Item# Description		Order-Release# 270495663 Revision Date 27-DEC-18		Revision Page 2 5 of Revision Buyer A CAPITAL				5
Line#		Rev#	Quantity UOM	Taxable	Unit Price	Extended	Price	Need	Date
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Ву			Buyer						Date

Supplier No 3000315

ALCOA CORPORATION

Phone (314) 423.9460 Fax (314) 428.4431

Supplier Contact
IAN MARSH
(314) 423.9460

United States

Supplier GILLESPIE & POWERS INC 9550 TRUE DRIVE SAINT LOUIS, MO 63132

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The above purchase lists, cartons, and co	order number must appear on all invoices, packing orrespondence related to this order
This PO incorporate	s by reference agreement number CW2074696AL
Order Date	Revision Date
21-AUG-18	10-DEC-19
Original Buyer	Revision Buyer
A CAPITAL	A CAPITAL
Buyer Contacts	A Company of the Comp
Phone	Fax
Email	capitalbuyer@alcoa.com
Ship To Alcoa Warrick LLC	Bill To Email to: alcoainvoices@digiscribe.info

 4400 W STATE ROUTE 66
 PO BOX 500

 Newburgh, IN 47630
 Elmsford, NY 10523

 United States
 United States

 Phone
 (812) 853-6111
 Phone

 Fax
 (812) 853-4122
 Fax

 Gov. Contract#
 Priority Rating#

OR Mail to:

Ship Via Freight Terms FOB
Freight Collect Destination-TitleTransfer

CR BLDG 47 (SS134-17)

Payment Terms Currency
NET 30 DAYS USD

Alcoa requires suppliers to utilize the BestTransport Supplier Connection Portal for shipments meeting the conditions set forth below:

Supplier Criteria for using BestTransport Supplier Connection

- * Alcoa Corporation responsible for freight payment to the carrier.
- * For shipments within North America (excluding inter and intra Mexico)
- * For single shipments weighing 150 lbs. or more
- * For motor carrier service shipped as Van, Flat Bed, or LTL.

Alcoa suppliers are to register with BestTransport Supplier Connection at http://supplier.bestshippers.com. To register, click on the Create Account button and enter the Alcoa account key 4alcoa (the key is case sensitive) and click the Submit button.

For assistance creating an account, entering shipment information, or shipment questions or problems, suppliers should contact Alcoa Central Dispatch at 1-866-209-3737 option 6 or via email at AlcoaCorpCD@alcoa.com. For assistance in French, contact the Transportation Group at 1-819-294-3036 or by email at DL-NerDepartementTransport@alcoa.com.

BestTransport Supplier Connection SHOULD NOT be used for urgent, over-dimensional, or any other shipment that requires special handling. Please contact Alcoa Central Dispatch or the Transportation Group for assistance.

Shipments weighing less than 150 lbs. with a destination in the United States are to be routed directly using Fed Ex Small Package, referencing the appropriate Alcoa Shipper Account Number. Shipments weighing less than 150 lbs. with a destination in Canada are to be routed directly using UPS Small Package, referencing the appropriate Alcoa Shipper Account Number.

PLEASE CONFIRM THIS PURCHASE ORDER TO USBuyandPaymentCenterGPP&ATC@alcoa.com In order to avoid short payment issues, please do not ship until you receive a revised PO. Our system does not allow us to update the price on POs after a receipt has been entered.

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ALCOA CORPORATION

CHANGE ORDER

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Supplier GILLESPIE & POWERS INC

PRICING

Please review this Purchase Order carefully. If prices, quantities, part numbers, and/or descriptions are not accurate, please contact the BUYER OF RECORD immediately.

TAX

DO NOT charge state sales/excise/use tax as these purchases are direct pay under Indiana Authorization # 0158155386-001

RECEIVING HOURS

Warrick Operations: Monday through Friday, 7:00am thru 1:30PM CST (unless otherwise instructed).

SHIPMENTS

Please also review shipping instructions listed above.

1. Shipment and paperwork must be marked with the Purchase Order number and Company name.

Packing list must be included and placed on outside of package.

2. For FEDEX shipments:

Warrick Operations: Bill to Alcoa account number: ***** 742696383 ***** Billing zip code: 47630.

- 3. Direct any collect freight bills to: Alcoa Corp c/o CT Logistics Team 8, P.O. Box 30382, Cleveland, OH 44130. To discuss FTP or EDI billing, contact CT Logistics at EDIMGR@ctlogistics.com.
- 4. Shipments must meet Good Manufacturing Practices (GMP).
- 5. Shipments must be CONEG compliant. Supplier assures all materials purchased for use in packaging comply with the CONEG Model Legislation regarding heavy metals in packaging materials.
- 6. FDA PACKAGING in the case where this material is to be used in packaging of articles or materials that will come in contact with food, acceptance of this order is conditioned on your assurance that the material covered herein is of suitable purity to be used in packaging and protecting articles or materials which come in contact with food.
- 7. Supplier shall not make any shipment containing loose Polystyrene Packing Material.
- 8. Shipments containing wood packaging material imported into the USA must comply with 7 CFR 319.40, Importation of Wood Packaging Material, Effective 9-16-05.
- 9. ¿ AŠBĚSTOS: ALCOA CORP WILL NOT ACCEPT ANY MATERIAL CONTAINING ASBESTOS. IT IS UP TO THE SUPPLIER TO ASSURE THAT NO PRODUCT FURNISHED TO ALCOA CONTAINS ASBESTOS.¿
- 10. Detergents containing phosphates: Alcoa Warrick will not accept any detergents/soaps containing phosphates intended for non-process/production usage. IT IS UP TO THE SUPPLIER TO ASSURE THAT DETERGENTS SUPPLIED TO ALCOA WARRICK FOR NON-PROCESS ACTIVITIES (SUCH AS VEHICLE WASHING, JANITORIAL AND GENERAL USAGE) DO NOT CONTAIN PHOSPHATE.

QUALITY REQUIREMENTS

- 1. System Requirements The supplier's quality system shall comply, at a minimum, with the requirements of ISO 9001 (current revision). The supplier's quality system shall be available at all times for review and approval by Alcoa Corp personnel.
- 2. Substitution of Material / Subcontracting Material or service Supplying substitute material or service or subcontracting of any portion of this work is not permitted unless approved by Alcoa in writing.
- 3. Changes The supplier must notify Alcoa Corp prior to making any significant change(s) to the process or product. This notification must include information regarding the expected performance difference(s) in the material or process due to the proposed change(s). Alcoa Corp reserves the right to require qualification material be supplied to verify process impact prior to receipt of order quantities.
- 4. Right of Access For quality audit purposes, Alcoa Corp, Alcoa Corp's customer and regulatory agencies will have access to approved supplier's facilities including subcontractor facilities with appropriate notifications for the purpose of verifying the quality of the product or service. This includes access to all facilities involved in this order and all applicable quality records including those of the calibration system.
- 5. Record Retention (General) Supplier must maintain all quality records relating to the production/processing of this order for a minimum of 7 years after the material has been shipped. If this requirement cannot be met, the quality records must be transferred to Alcoa Corp at the completion of the work.
- 6. Non-Conforming or Discrepant Material If material delivered to Alcoa Corp is found to be non-conforming, supplier must provide all necessary information for traceability purposes and obtain, in writing from Alcoa Corp Procurement, acceptance or

ALCOA CORPORATION

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GILLESPIE & POWERS INC

rejection of the material. When a corrective action is deemed necessary, the supplier will receive a corrective action request (CAR) form. The supplier must provide a written response within 14 working days documenting root cause, corrective actions taken, effective date and signature of quality assurance representative. Delinquency on or no response to corrective action requests may cause reevaluation of supplier's quality system's approval and may preclude issuance of new purchase orders/contracts.

MATERIAL SAFETY DATA SHEETS (MSDS)

MSDS must be supplied at the time of the initial shipment of the hazardous material to Alcoa Corp, preferably by mail. MSDS must also be supplied at the time of the next order request after the MSDS has been revised, reviewed, or otherwise modified by the manufacturer.

INVOICING INFORMATION:

Invoices must be submitted to Alcoa following the instructions in the Bill To section of this purchase order.

If the Bill To reads XML Invoice Required, do not submit a paper invoice. Invoices must be submitted using Alcoats B2B solution.

If the Bill To reads NO INV USE ICLAIM, do not submit a paper invoice. Invoice must be submitted using Alcoa¿s SPR (iClaim) system in Alcoa Direct. All supporting documentation must be included with the submission.

If the Bill To reads PFR No Invoice Required, do not submit a paper invoice. Alcoa will generate an invoice based on receipt of goods at the location.

If the Bill To specifies Alcoa¿s invoice email address and PO box, please note that Alcoa prefers paper invoices be submitted via email. Only if email cannot be used should the PO Box be used. Select only one method of transmission.

For all paper invoices, the invoice must include the following on the first page of the invoice: Purchase order number Invoice number The invoice period

The Supplier is name

The Supplier is remit-to address

At a minimum for Services, supporting documentation must include hours expended, date work was performed, actual name and/or classification of the worker performing the work, rate per hour, extended dollar amount, description of the work, travel & entertainment expenses itemized and including receipts for any expense greater than \$25 USD, supporting documentation for subcontracted services (including actual invoices from the sub-contractors).

Credits must be submitted as a separate credit memo stating the correction to the prior invoice number and reason for the credit. Do not include the credit on the next invoice.

Supplier inquiries about invoice / payment processing should be directed to Customer Support via email at usap@alcoa.com. In addition, Suppliers can check on the status of payments by using http://alcoadirect.com.

US CUSTOMS REASONABLE CARE STANDARDS REQUIREMENT

Itemized invoice and NAFTA certificate of origin (if applicable) must accompany shipment. Documents must contain the following details: purchase order #, model #, Dimension of crate/carton, serial #, weight per piece, description, ship from Location, country of origin, ship to location, ship date, purchase price, expected Delivery date, harmonized tariff #, carton/crate # item packed in, note: we will assist you if you do not know the harmonized tariff number. Contact Amador Cardenas at 865-695-4585 prior to making shipment. The harmonized tariff number must be on the Shipping invoice.

INTERNATIONAL SHIPPING REQUIREMENTS

Case 1:23-cv-00273-GBW

Document 1-1 Filed 02/08/22

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CHANGE ORDER

ALCOA CORPORATION

Order-Release# Revision Page
270495663 3 4 of 5
Revision Date Revision Buyer
10-DEC-19 A CAPITAL

Supplier
GILLESPIE & POWERS INC

Attn: Carlos Sierra

SUPPLIER MUST CONTACT CONTAINER SOLUTION CENTER AT alan.mcdonell@alcoa.com TO ENSURE TRANSPORTATION HAS BEEN ARRANGED AHEAD OF TIME.

PLEASE HAVE THE FOLLOWING AND SEND IT TO: alan.mcdonell@alcoa.com:
WEIGHT, DIMS, AND NUMBER OF PIECES ALONG WITH FULL ADDRESS AND CONTACT PERSON(S) AT THE SUPPLIER ALONG WITH A COPY OF PURCHASE ORDER.

ALCOA, S IMPORT BROKER CONTACT:
Ocean and Air Imports
Livingston International
3625 NW 82nd Ave, suite 107
Miami FL 33166 attn: team 17
alcoaimports@livingstonintl.com
PH: (305) 219-5548

COUNTRY OF ORIGIN REQUIREMENTS

- 1. Country of Origin Marking: The producer and /or foreign exporter must comply with the U.S. Customs and Border Protection Marking requirements (19 CFR 134- see below) by indicating clearly the country of origin in which the goods were produced on each article and outer package.
- 2. The requirements of 19 U.S.C. 1304 and 19 CFR Part 134 provide that imported articles or their containers must be marked in a conspicuous place as legibly, indelibly and permanently as the nature of the article or container will permit, in such a manner as to indicate to an ultimate purchaser in the United States, the English name of the country of origin of the article.

Payment schedule in accordance with the commercial proposal.

PRIOR TO THE START OF ANY WORK ONSITE.

Line#	Item# Description	Rev#	Quantity	UOM	Taxable	Unit Price	Extended Price	Need Date
4					N		11,503,957.00	29-MAY-20
	Down-payment for GP t Addendum Log No 10,			•	•	•	•	29-MAY-20

Ship To

Shipment # 1 Address at top of page

Deliver To: HAYNES, TERRY A [Terry.Haynes@Alcoa.com]

(11.503.957.00)

CHANGE ORDER

ALCOA CORPORATION Supplier GILLESPIE & POWERS INC			Order-Release# 270495663 Revision Date 10-DEC-19		Revision 3 ion Buyer CAPITAL	Page 5	e of	5
Line#	Item# Description	Rev#	Quantity UOM	Taxable Unit Price	Extended i	Price	Nee	d Date
33 mg mga 1.00	TO A STATE OF THE CASE	eria de veza, _{usole} .	The second second	Purchase Order Total	· - •	- 44	12,212	2,332.00
Ву			Buyer					Date

Order-Release#

270495663

Order Date

ALCOA CORPORATION

Supplier No

Phone Fax

(314) 423.9460 (314) 428.4431...

Supplier Contact

IAN MARSH (314) 423.9460

Supplier

GILLESPIE & POWERS INC 9550 TRUE DRIVE SAINT LOUIS, MO 63132

Payment Terms

NET 30 DAYS

United States

3000315

21-AUG-18 **Original Buyer**

A CAPITAL **Buyer Contacts**

Phone Email

Revision Date 18-MAR-20

Revision

Page

5

Revision Buyer - - A CAPITAL

OR Mail to:

PO BOX 500

United States

Elmsford, NY 10523

Fax capitalbuver@alcoa.com

The above purchase order number must appear on all invoices, packing

This PO incorporates by reference agreement number CW2074696AL

lists, cartons, and correspondence related to this order

Ship To **Bill To** Email to: alcoainvoices@digiscribe.info

Alcoa Warrick LLC CR BLDG 47 (SS134-17) 4400 W STATE ROUTE 66 Newburgh, IN 47630

United States Phone

(812) 853-6111 (812) 853-4122

Phone Fax

Gov. Contract#

Priority Rating#

Freight Terms **FOB** Ship Via

Fax

Freight Collect Currency

USD

Destination-TitleTransfer

Alcoa requires suppliers to utilize the BestTransport Supplier Connection Portal for shipments meeting the conditions set forth below:

Supplier Criteria for using BestTransport Supplier Connection

- * Alcoa Corporation responsible for freight payment to the carrier.
- * For shipments within North America (excluding inter and intra Mexico)
- * For single shipments weighing 150 lbs. or more
- * For motor carrier service shipped as Van, Flat Bed, or LTL.

Alcoa suppliers are to register with BestTransport Supplier Connection at http://supplier.bestshippers.com. To register, click on the Create Account button and enter the Alcoa account key 4alcoa (the key is case sensitive) and click the Submit button.

For assistance creating an account, entering shipment information, or shipment questions or problems, suppliers should contact Alcoa Central Dispatch at 1-866-209-3737 option 6 or via email at AlcoaCorpCD@alcoa.com. For assistance in French, contact the Transportation Group at 1-819-294-3036 or by email at DL-NerDepartementTransport@alcoa.com.

BestTransport Supplier Connection SHOULD NOT be used for urgent, over-dimensional, or any other shipment that requires special handling. Please contact Alcoa Central Dispatch or the Transportation Group for assistance.

Shipments weighing less than 150 lbs. with a destination in the United States are to be routed directly using Fed Ex Small Package, referencing the appropriate Alcoa Shipper Account Number. Shipments weighing less than 150 lbs. with a destination in Canada are to be routed directly using UPS Small Package, referencing the appropriate Alcoa Shipper Account Number.

PLEASE CONFIRM THIS PURCHASE ORDER TO USBuyandPaymentCenterGPP&ATC@alcoa.com In order to avoid short payment issues, please do not ship until you receive a revised PO. Our system does not allow us to update the price on POs after a receipt has been entered.

ALCOA CORPORATION

Order-Release# Revision Page
270495663 4 2 of 5
Revision Date Revision Buyer
18-MAR-20 A CAPITAL

Supplier
GILLESPIE & POWERS INC

PRICING

Please review this Purchase Order carefully. If prices, quantities, part numbers, and/or descriptions are not accurate, please contact the BUYER OF RECORD immediately.

TAX

DO NOT charge state sales/excise/use tax as these purchases are direct pay under Indiana Authorization # 0158155386-001

RECEIVING HOURS

Warrick Operations: Monday through Friday, 7:00am thru 1:30PM CST (unless otherwise instructed).

SHIPMENTS

Please also review shipping instructions listed above.

1. Shipment and paperwork must be marked with the Purchase Order number and Company name.

Packing list must be included and placed on outside of package.

2. For FEDEX shipments:

Warrick Operations: Bill to Alcoa account number: ***** 742696383 ***** Billing zip code: 47630.

- 3. Direct any collect freight bills to: Alcoa Corp c/o CT Logistics Team 8, P.O. Box 30382, Cleveland, OH 44130. To discuss FTP or EDI billing, contact CT Logistics at EDIMGR@ctlogistics.com.
- 4. Shipments must meet Good Manufacturing Practices (GMP).
- 5. Shipments must be CONEG compliant. Supplier assures all materials purchased for use in packaging comply with the CONEG Model Legislation regarding heavy metals in packaging materials.
- 6. FDA PACKAGING ¿ In the case where this material is to be used in packaging of articles or materials that will come in contact with food, acceptance of this order is conditioned on your assurance that the material covered herein is of sultable purity to be used in packaging and protecting articles or materials which come in contact with food.
- 7. Supplier shall not make any shipment containing loose Polystyrene Packing Material.
- 8. Shipments containing wood packaging material imported into the USA must comply with 7 CFR 319.40, Importation of Wood Packaging Material, Effective 9-16-05.
- 9. ¿ AŠBĚSTOS: ALCOA CORP WILL NOT ACCEPT ANY MATERIAL CONTAINING ASBESTOS. IT IS UP TO THE SUPPLIER TO ASSURE THAT NO PRODUCT FURNISHED TO ALCOA CONTAINS ASBESTOS. ¿
- 10. Detergents containing phosphates: Alcoa Warrick will not accept any detergents/soaps containing phosphates intended for non-process/production usage. IT IS UP TO THE SUPPLIER TO ASSURE THAT DETERGENTS SUPPLIED TO ALCOA WARRICK FOR NON-PROCESS ACTIVITIES (SUCH AS VEHICLE WASHING, JANITORIAL AND GENERAL USAGE) DO NOT CONTAIN PHOSPHATE.

QUALITY REQUIREMENTS

- 1. System Requirements The supplier's quality system shall comply, at a minimum, with the requirements of ISO 9001 (current revision). The supplier's quality system shall be available at all times for review and approval by Alcoa Corp personnel.
- 2. Substitution of Material / Subcontracting Material or service Supplying substitute material or service or subcontracting of any portion of this work is not permitted unless approved by Alcoa in writing.
- 3. Changes The supplier must notify Alcoa Corp prior to making any significant change(s) to the process or product. This notification must include information regarding the expected performance difference(s) in the material or process due to the proposed change(s). Alcoa Corp reserves the right to require qualification material be supplied to verify process impact prior to receipt of order quantities.
- 4. Right of Access For quality audit purposes, Alcoa Corp, Alcoa Corp's customer and regulatory agencies will have access to approved supplier's facilities including subcontractor facilities with appropriate notifications for the purpose of verifying the quality of the product or service. This includes access to all facilities involved in this order and all applicable quality records including those of the calibration system.
- 5. Record Retention (General) Supplier must maintain all quality records relating to the production/processing of this order for a minimum of 7 years after the material has been shipped. If this requirement cannot be met, the quality records must be transferred to Alcoa Corp at the completion of the work.
- 6. Non-Conforming or Discrepant Material If material delivered to Alcoa Corp is found to be non-conforming, supplier must provide all necessary information for traceability purposes and obtain, in writing from Alcoa Corp Procurement, acceptance or

ALÇOA CORPORATION

CHANGE ORDER

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Supplier
GILLESPIE & POWERS INC

rejection of the material. When a corrective action is deemed necessary, the supplier will receive a corrective action request (CAR) form. The supplier must provide a written response within 14 working days documenting root cause, corrective actions taken, effective date and signature of quality assurance representative. Delinquency on or no response to corrective action requests may cause reevaluation of supplier's quality system's approval and may preclude issuance of new purchase orders/contracts.

MATERIAL SAFETY DATA SHEETS (MSDS)

MSDS must be supplied at the time of the initial shipment of the hazardous material to Alcoa Corp, preferably by mail. MSDS must also be supplied at the time of the next order request after the MSDS has been revised, reviewed, or otherwise modified by the manufacturer.

INVOICING INFORMATION:

Invoices must be submitted to Alcoa following the instructions in the Bill To section of this purchase order.

If the Bill To reads XML Invoice Required, do not submit a paper invoice. Invoices must be submitted using Alcoays B2B solution.

If the Bill To reads NO INV USE ICLAIM, do not submit a paper invoice. Invoice must be submitted using Alcoa¿s SPR (iClaim) system in Alcoa Direct. All supporting documentation must be included with the submission.

If the Bill To reads PFR No Invoice Required, do not submit a paper invoice. Alcoa will generate an invoice based on receipt of goods at the location.

If the Bill To specifies Atcoa¿s invoice email address and PO box, please note that Alcoa prefers paper invoices be submitted via email. Only if email cannot be used should the PO Box be used. Select only one method of transmission.

For all paper invoices, the invoice must include the following on the first page of the invoice: Purchase order number Invoice number The invoice period The Supplier¿s name The Supplier¿s remit-to address

At a minimum for Services, supporting documentation must include hours expended, date work was performed, actual name and/or classification of the worker performing the work, rate per hour, extended dollar amount, description of the work, travel & entertainment expenses itemized and including receipts for any expense greater than \$25 USD, supporting documentation for subcontracted services (including actual invoices from the sub-contractors).

Credits must be submitted as a separate credit memo stating the correction to the prior invoice number and reason for the credit. Do not include the credit on the next invoice.

Supplier inquiries about invoice / payment processing should be directed to Customer Support via email at usap@alcoa.com. In addition, Suppliers can check on the status of payments by using http://alcoadirect.com.

US CUSTOMS REASONABLE CARE STANDARDS REQUIREMENT

Itemized invoice and NAFTA certificate of origin (if applicable) must accompany shipment. Documents must contain the following details: purchase order #, model #, Dimension of crate/carton, serial #, weight per piece, description, ship from Location, country of origin, ship to location, ship date, purchase price, expected Delivery date, harmonized tariff #, carton/crate # item packed in, note: we will assist you if you do not know the harmonized tariff number. Contact Amador Cardenas at 865-695-4585 prior to making shipment. The harmonized tariff number must be on the Shipping invoice.

INTERNATIONAL SHIPPING REQUIREMENTS

ALCOA CORPORATION

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18-MAR-20 A CAPITAL

(12.189.685.00)

Supplier
GILLESPIE & POWERS INC

SUPPLIER MUST CONTACT CONTAINER SOLUTION CENTER AT alan.mcdonell@alcoa.com TO ENSURE TRANSPORTATION HAS BEEN ARRANGED AHEAD OF TIME.

PLEASE HAVE THE FOLLOWING AND SEND IT TO: alan.mcdonell@alcoa.com:
WEIGHT, DIMS, AND NUMBER OF PIECES ALONG WITH FULL ADDRESS AND CONTACT PERSON(S) AT THE SUPPLIER

ALCOA¿S IMPORT BROKER CONTACT:

ALONG WITH A COPY OF PURCHASE ORDER.

Livingston International 3625 NW 82nd Ave, suite 107 Miami FL 33166 attn: team 17 alcoaimports@livingstonintl.com

PH: (305) 219-5548 Attn: Carlos Sierra

Ocean and Air Imports

COUNTRY OF ORIGIN REQUIREMENTS

Deliver To: HAYNES, TERRY A [Terry.Haynes@Alcoa.com]

1. Country of Origin Marking: The producer and /or foreign exporter must comply with the U.S. Customs and Border Protection Marking requirements (19 CFR 134- see below) by indicating clearly the country of origin in which the goods were produced on each article and outer package.

Purchase Order Acceptance: (PLEASE COMPLETE AND RETURN TO BUYER AS SOON AS POSSIBLE)

2. The requirements of 19 U.S.C. 1304 and 19 CFR Part 134 provide that imported articles or their containers must be marked in a conspicuous place as legibly, indelibly and permanently as the nature of the article or container will permit, in such a manner as to indicate to an ultimate purchaser in the United States, the English name of the country of origin of the article.

Seller agrees to all the terms and conditions and requirements stated in this purchase order and all attachments.

Accepted by:

Printed Name:

Company Name:

Date:

PLEASE SIGN THE ACCEPTANCE CLAUSE OF THIS PURCHASE ORDER AND RETURN TO US PSC BUYER VIA EMAIL TO USBuyandPaymentCenterGPP&ATC@ALCOA.COM. PLEASE NOTE THAT THIS ACCEPTANCE PAGE MUST BE RETURNED PRIOR TO THE START OF ANY WORK ONSITE.

Payment schedule in accordance with the commercial proposal. Rev# Quantity UOM Taxable Unit Price Item# **Need Date** Line# Extended Price Description 31-JUL-20 Ν 12,189,685.00 4 Down-payment for GP to order materials for the Coated Scrap Melter Project per attached Alcoa RFQ R1. 31-JUL-20 Addendum Log No 10, GP Commercial Proposal R6, Technical Proposal R1, and Schedule R2. Ship To Shipment # Address at top of page

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~	12	A I	ᇈ	UIV	·	-	•

ALCOA CORPORATION Supplier SILLESPIE & POWERS INC Line# Item# Re Description			Order-Release# 270495663 Revision Date 18-MAR-20		Revision Pag 4 5 Revision Buyer A CAPITAL			e of 5	
Line#		Rev#	Quantity UOM	Taxable	Unit Price	Extended	Price	Nee	d Date
			ार प्रकार क्षेत्रकार है।	Purcha	se Order Tota			12,898	,060.00
Ву		***	Buyer					· 	Date

OPICIAL-11, 634, 600

EXTRAS-1,263,460

PAID - 221,415

EXTRAS STILL-1,042,045

OPEN

GP Joh 8995

STANDARD PURCHASE ORDER

ALCOA CORPO	ALCOA CORPORATION Supplier No. 2000215			Revision	Page 1 of 7						
				roices, packing lists, cartons, an							
Supplier No	3000315	This PO Incorporates by reference agreement number CW2074596AL									
Phone Fax Supplier Contact	(314) 423.9460 (314) 428.4431	Order Date 29-OCT-19 Buyer A CAPITAL	Em	ione							
IAN MARSH (314) 423.9460		Ship To Alcoa Warrick LLC		Bill To Email to: alcoainvo	BIII To Email to: alcoainvoices@digiscribe.info OR Mail to: PO BOX 500						
Supplier GILLESPIE & POW	& POWERS INC	CR BLDG 47 (SS134F 4400 W STATE ROUT		PO BOX 500							
9550 TRUE DRIVE		Newburgh, IN 47630 United States		Elmsford, NY 1052 United States	Elmsford, NY 10523						
SAINT LOUIS, MO United States		Phone	(812) 853-6111	Phone Fax							
		Fax Gov. Contract#	Fax (812) 853-4122 Gov. Contract#		Priority Rating#						
Ship Via	Ship Via		Freight Terms		FOB						
B		Freight Collect		Destination-TitleTra	ınsfer						
1 *	Payment Terms NET DUE 4TH OF FOURTH MONTH			Currency USD	J						

Alcoa requires suppliers to utilize the BestTransport Supplier Connection Portal for shipments meeting the conditions set forth below:

Supplier Criteria for using BestTransport Supplier Connection

- * Alcoa Corporation responsible for freight payment to the carrier.
- * For shipments within North America (excluding inter and intra Mexico)
- * For single shipments weighing 150 lbs. or more
- * For motor carrier service shipped as Van, Flat Bed, or LTL.

Alcoa suppliers are to register with BestTransport Supplier Connection at http://supplier.bestshippers.com. To register, click on the Create Account button and enter the Alcoa account key 4alcoa (the key is case sensitive) and click the Submit button.

For assistance creating an account, entering shipment information, or shipment questions or problems, suppliers should contact Alcoa Central Dispatch at 1-866-209-3737 option 6 or via email at AlcoaCorpCD@alcoa.com. For assistance in French, contact the Transportation Group at 1-819-294-3036 or by email at DL-NerDepartementTransport@alcoa.com.

BestTransport Supplier Connection SHOULD NOT be used for urgent, over-dimensional, or any other shipment that requires special handling. Please contact Alcoa Central Dispatch or the Transportation Group for assistance.

Shipments weighing less than 150 lbs. with a destination in the United States are to be routed directly using Fed Ex Small Package, referencing the appropriate Alcoa Shipper Account Number. Shipments weighing less than 150 lbs. with a destination in Canada are to be routed directly using UPS Small Package, referencing the appropriate Alcoa Shipper Account Number.

PLEASE CONFIRM THIS PURCHASE ORDER TO USBuyandPaymentCenterGPP&ATC@alcoa.com In order to avoid short payment issues, please do not ship until you receive a revised PO. Our system does not allow us to update the price on POs after a receipt has been entered.

PRICING

Please review this Purchase Order carefully. If prices, quantities, part numbers, and/or descriptions are not accurate, please contact the BUYER OF RECORD immediately.

TAX

DO NOT charge state sales/excise/use tax as these purchases are direct pay under Indiana Authorization # 0158155386-001

RECEIVING HOURS

Warrick Operations: Monday through Friday, 7:00am thru 1:30PM CST (unless otherwise instructed).

SHIPMENTS

Please also review shipping instructions listed above.

1. Shipment and paperwork must be marked with the Purchase Order number and Company name.

STANDARD PURCHASE ORDER

ALCOA CORPORATION

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270546413 2 of 7
Order Date
29-OCT-19 A CAPITAL

Supplier
GILLESPIE & POWERS INC

Packing list must be included and placed on outside of package.

2. For FEDEX shipments:

Warrick Operations: Bill to Alcoa account number: ***** 742696383 ***** Billing zip code: 47630.

- 3. Direct any collect freight bills to: Alcoa Corp c/o CT Logistics Team 8, P.O. Box 30382, Cleveland, OH 44130. To discuss FTP or EDI billing, contact CT Logistics at EDIMGR@ctlogistics.com.
- 4. Shipments must meet Good Manufacturing Practices (GMP).
- 5. Shipments must be CONEG compliant. Supplier assures all materials purchased for use in packaging comply with the CONEG Model Legislation regarding heavy metals in packaging materials.
- 6. FDA PACKAGING ¿ In the case where this material is to be used in packaging of articles or materials that will come in contact with food, acceptance of this order is conditioned on your assurance that the material covered herein is of suitable purity to be used in packaging and protecting articles or materials which come in contact with food
- 7. Supplier shall not make any shipment containing loose Polystyrene Packing Material.
- 8. Shipments containing wood packaging material imported into the USA must comply with 7 CFR 319.40, Importation of Wood Packaging Material, Effective 9-16-05.
- 9. ¿ ASBESTOS: ALCOA CORP WILL NOT ACCEPT ANY MATERIAL CONTAINING ASBESTOS. IT IS UP TO THE SUPPLIER TO ASSURE THAT NO PRODUCT FURNISHED TO ALCOA CONTAINS ASBESTOS. ¿ 10. Detergents containing phosphates: Alcoa Warrick will not accept any detergents/soaps containing phosphates intended for non-process/production usage. IT IS UP TO THE SUPPLIER TO ASSURE THAT DETERGENTS SUPPLIED TO ALCOA WARRICK FOR NON-PROCESS ACTIVITIES (SUCH AS VEHICLE WASHING, JANITORIAL AND GENERAL USAGE) DO NOT CONTAIN PHOSPHATE.

QUALITY REQUIREMENTS

- System Requirements The supplier's quality system shall comply, at a minimum, with the requirements of ISO 9001 (current revision). The supplier's quality system shall be available at all times for review and approval by Alcoa Corp personnel.
- 2. Substitution of Material / Subcontracting Material or service Supplying substitute material or service or subcontracting of any portion of this work is not permitted unless approved by Alcoa in writing.
- 3. Changes The supplier must notify Alcoa Corp prior to making any significant change(s) to the process or product. This notification must include information regarding the expected performance difference(s) in the material or process due to the proposed change(s). Alcoa Corp reserves the right to require qualification material be supplied to verify process impact prior to receipt of order quantities.
- 4. Right of Access For quality audit purposes, Alcoa Corp, Alcoa Corp's customer and regulatory agencies will have access to approved supplier's facilities including subcontractor facilities with appropriate notifications for the purpose of verifying the quality of the product or service. This includes access to all facilities involved in this order and all applicable quality records including those of the calibration system.
- 5. Record Retention (General) Supplier must maintain all quality records relating to the production/processing of this order for a minimum of 7 years after the material has been shipped. If this requirement cannot be met, the quality records must be transferred to Alcoa Corp at the completion of the work.
- 6. Non-Conforming or Discrepant Material If material delivered to Alcoa Corp is found to be non-conforming, supplier must provide all necessary information for traceability purposes and obtain, in writing from Alcoa Corp Procurement, acceptance or rejection of the material. When a corrective action is deemed necessary, the supplier will receive a corrective action request (CAR) form. The supplier must provide a written response within 14 working days documenting root cause, corrective actions taken, effective date and signature of quality assurance representative. Delinquency on or no response to corrective action requests may cause reevaluation of supplier's quality system's approval and may preclude issuance of new purchase orders/contracts.

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MSDS must be supplied at the time of the initial shipment of the hazardous material to Alcoa Corp, preferably by mail. MSDS must also be supplied at the time of the next order request after the MSDS has been revised, reviewed, or otherwise modified by the manufacturer.

INVOICING INFORMATION:

Invoices must be submitted to Alcoa following the instructions in the Bill To section of this purchase order.

If the Bill To reads XML Invoice Required, do not submit a paper invoice. Invoices must be submitted using Alcoa¿s B2B solution.

If the Bill To reads NO INV USE ICLAIM, do not submit a paper invoice. Invoice must be submitted using Alcoa¿s SPR (iClaim) system in Alcoa Direct. All supporting documentation must be included with the submission.

STANDARD PURCHASE ORDER

ALCOA CORPORATION

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 Order Date
 Buyer

 29-OCT-19
 A CAPITAL

Supplier
GILLESPIE & POWERS INC

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For all paper invoices, the invoice must include the following on the first page of the invoice: Purchase order number Invoice number The invoice period The Supplier¿s name The Supplier¿s remit-to address

At a minimum for Services, supporting documentation must include hours expended, date work was performed, actual name and/or classification of the worker performing the work, rate per hour, extended dollar amount, description of the work, travel & entertainment expenses itemized and including receipts for any expense greater than \$25 USD, supporting documentation for sub-contracted services (including actual invoices from the sub-contractors).

Credits must be submitted as a separate credit memo stating the correction to the prior invoice number and reason for the credit. Do not include the credit on the next invoice.

Supplier inquiries about invoice / payment processing should be directed to Customer Support via email at usap@alcoa.com. In addition, Suppliers can check on the status of payments by using http://alcoadirect.com.

US CUSTOMS REASONABLE CARE STANDARDS REQUIREMENT

Itemized invoice and NAFTA certificate of origin (if applicable) must accompany shipment. Documents must contain the following details: purchase order #, model #, Dimension of crate/carton, serial #, weight per piece, description, ship from Location, country of origin, ship to location, ship date, purchase price, expected Delivery date, harmonized tariff #, carton/crate # item packed in, note: we will assist you if you do not know the harmonized tariff number. Contact Amador Cardenas at 865-695-4585 prior to making shipment. The harmonized tariff number must be on the Shipping invoice.

INTERNATIONAL SHIPPING REQUIREMENTS

SUPPLIER MUST CONTACT CONTAINER SOLUTION CENTER AT alan.mcdonell@alcoa.com TO ENSURE TRANSPORTATION HAS BEEN ARRANGED AHEAD OF TIME.

PLEASE HAVE THE FOLLOWING AND SEND IT TO: alan.mcdonell@alcoa.com: WEIGHT, DIMS, AND NUMBER OF PIECES ALONG WITH FULL ADDRESS AND CONTACT PERSON(S) AT THE SUPPLIER ALONG WITH A COPY OF PURCHASE ORDER.

ALCOALS IMPORT BROKER CONTACT:

Ocean and Air Imports
Livingston International
3625 NW 82nd Ave, suite 107
Miami FL 33166 attn: team 17
alcoaimports@livingstonintl.com
PH: (305) 219-5548

Attn: Carlos Sierra

COUNTRY OF ORIGIN REQUIREMENTS

- 1. Country of Origin Marking: The producer and /or foreign exporter must comply with the U.S. Customs and Border Protection Marking requirements (19 CFR 134- see below) by indicating clearly the country of origin in which the goods were produced on each article and outer package.
- 2. The requirements of 19 U.S.C. 1304 and 19 CFR Part 134 provide that imported articles or their containers must be marked in a conspicuous place as legibly, indelibly and permanently as the nature of the article or container will permit, in such a manner as to indicate to an ultimate purchaser in the United States, the English name of the country of origin of the article.

Purchase Order Acceptance: (PLEASE COMPLETE AND RETURN TO BUYER AS SOON AS POSSIBLE) Seller agrees to all the terms and conditions and requirements stated in this purchase order and all